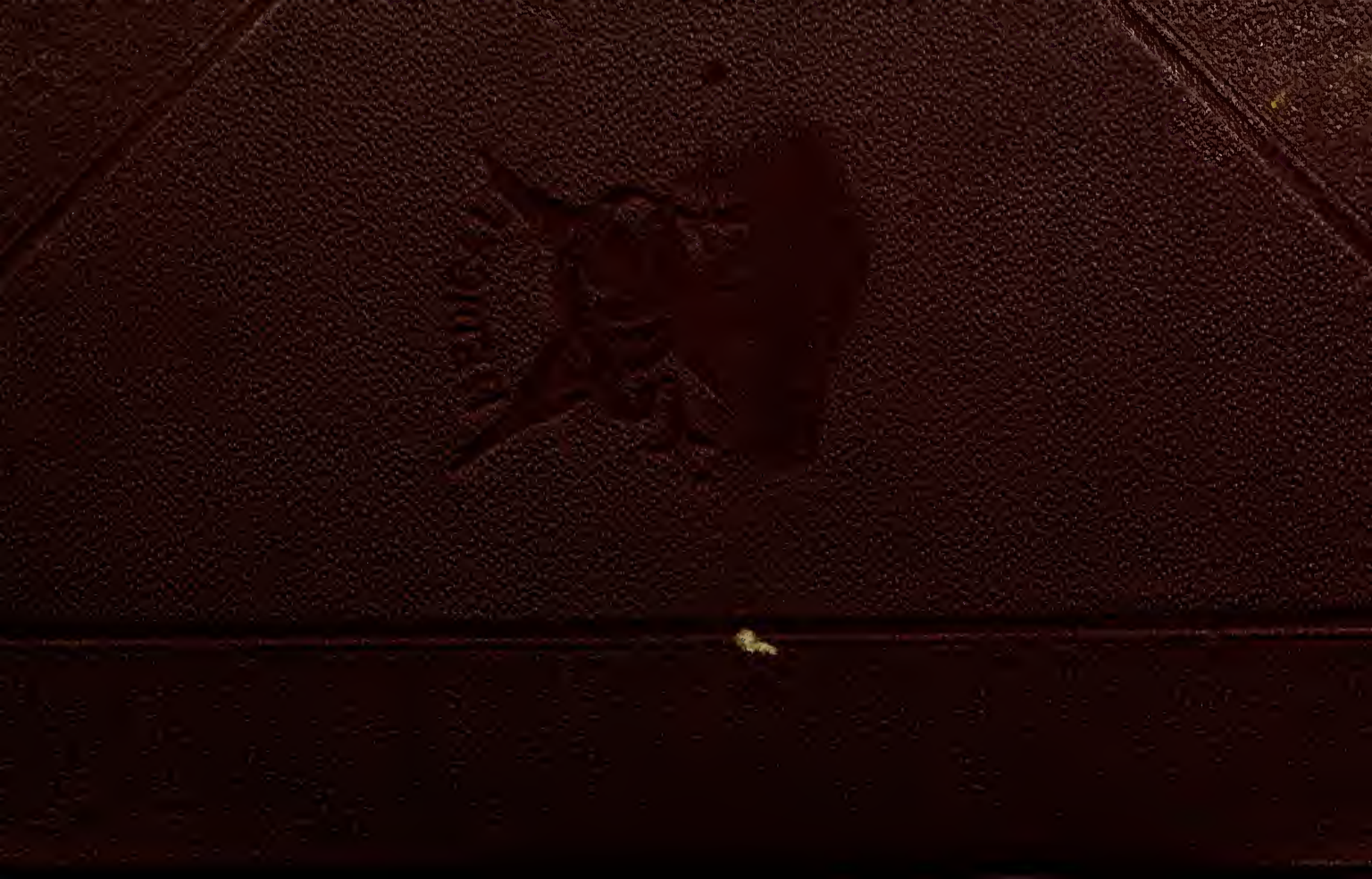

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A TREATISE

ON

HEADACHE AND NEURALGIA,

INCLUDING

SPINAL IRRITATION AND A DISQUISITION ON NORMAL AND MORBID SLEEP.

BY

J. LEONARD CORNING, M.A., M.D.,

Consultant in Nervous Diseases to St. Francis Hospital; Fellow of the New York Academy of Medicine; Member of the New York Neurological Society; etc.

AUTHOR OF

"A Treatise on Hysteria and Epilepsy," "Local Anæsthesia," "Brain Rest," etc.

WITH AN APPENDIX.

EYE STRAIN, A CAUSE OF HEADACHE,

By DAVID WEDSTER, M.D.,

Prof. of Ophthalmology in the New York Polyclinic; Surgeon to the Manhattan Eye and Ear Hospital, etc., etc.

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PREFACE.

The affections treated of in the following pages have ever shown a decided predilection for the neurotic portion of our population. For the great towns of the Atlantic seaboard, headaches and neuralgias exhibit a special preference. To the nervous exhaustion and strain incident to the irregular mode of life and competition of the great cities are due, in no small degree, these head-pains so often the precursors of impending nervous bankruptcy. The same causes, in conjunction with one of the most trying climates to be found in the whole world, serve also to give rise to a thousand aches and pains, the most excruciating of which are those neuralgias of the face that not infrequently drive the victim to suicide or the madhouse.

For several years past I have devoted much time to the careful study of these prolific sources of human misery. I have not done this in a spirit of mere pathological analysis; but I can truly say that my endeavors have been of a practical kind, every thought being directed to the relief and cure of these distressing affections.

As insomnia is one of the most constant and dis-

tressing accompaniments of pain, I have added a chapter on sleep and its derangements, which I trust will lend completeness to the general argument.

When to personal experience I add the fact, that many of the principles herein formulated have already been extensively promulgated and kindly received by my professional brethren on both sides of the Atlantic, I may perhaps claim extenuation for confidence placed in my own undertakings.

PREFACE TO THE SECOND EDITION.

THE kind reception which the first edition of this work received at the hands of the profession has been an agreeable surprise to the author.

As regards the second edition, I may state that the value of the work has been materially enhanced by the addition of an appendix on the relation of eye strain to headache, contributed by my distinguished friend, Dr. David Webster, of New York.

Dr. Webster's reputation as an accomplished ophthalmologist is a sufficient guarantee of the soundness of his opinions.

J. L. CORNING.

New York, September 1st, 1889.

PREFACE TO THE THIRD EDITION.

To this, the third edition, I have added a chapter on the "Localization of the Action of Remedies upon the Brain," which I trust may prove suggestive as well as useful.

J. L. CORNING.

New York, January 1st, 1894.

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PART I.

HEADACHE.

PAINS WHICH OWE THEIR ORIGIN TO INTRA-CRANIAL CAUSES.

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CHAPTER I.

INTRODUCTORY AND RETROSPECTIVE.

GENERAL CONSIDERATIONS ON THE MECHANISM OF HEAD-PAINS.—CLASSIFICATION OF HEAD-PAINS.

Under the designation of headache, I propose to consider a group of painful sensations located in the head, and usually accompanied by more or less sensory hyperæsthesia, mental irritability and intellectual prostration.

As the clinical significance of these head-pains differs more or less widely, it is not surprising that they should be attributable to the most varied causes. Thus experience has shown that some of these painful sensations about the head may be due to extra-cranial causes, such as osteosis of the cranium and dura mater, syphilitic periostitis of the cranium, disease of the internal ear, neuralgic and rheumatic affections of the scalp, and tumors of various kinds. On the other hand, it is equally certain that an extensive category of headaches is directly attributable to intra-cranial causes. Under the latter conditions the mental disturbances are decidedly more marked than when the cause of the pain is located externally to the cranial vault, and we are therefore justified in speaking of these headaches as cerebral or brain-pains.

Before proceeding to discuss the symptomatology of headaches, it will be well to consider the mechanism

of their production, as classification and treatment are alike dependent upon some conception, however imperfect, of the pathological features involved.

Of the purely extra-cranial pains little more need be said than that they are evidently one and all attributable to disturbances in the molecular conditions of the sensory nerves involved. Whether the immediate source of such disturbances be an organic lesion (exostosis, syphilitic periostitis), or whether it consists in some occult external (rheumatic, neuralgic) element, matters little in so far as the final result is concerned.

The elucidation of the mechanism of the intra-cranial or brain-pains is, however, a matter of far greater difficulty. In considering this point, Dr. Symonds[1] pertinently observes: "Putting aside for the present any reference to the patient's feelings, what do we learn from anatomical considerations as to the probable source of pain within the cranium when the patient is the subject of headache? It does not appear to be in the nervous matter, whether vesicular or tubular, of the cerebral hemispheres, or of the cerebellum. No evidence of feeling has been obtained by vivisectors till they approach the sensory ganglia, the thalami optici and corpora quadrigemina. But these are the centres of sensations to all parts of the body as well as to the head. All analogy must further look to the nerves as the source of pain (though some writers are hardy enough to doubt the necessity of nervous matter as instrumental in sensation). And what are the nerves? Numerous as are the nerves which come out of the cranium, there are on a superficial view very few that go into it. A branch of the suboccipital accompanies the vertebral artery, but a large majority

[1] "The Gulstonian Lectures on Headache," Medical Times and Gazette," 1858.

of the other nerves, destined for intra-cranial purposes, are derived from the sympathetic.

"These, then, are the nerves which are of chief interest to our present inquiry. Nerves of this class accompany blood-vessels, and when we observe the large amount of these vessels, the brain and its membranes being more liberally supplied with blood than any other organ (the quantity being computed as one-fifth of the blood of the whole body), we might, without searching further, feel convinced that there must be a corresponding supply of ganglionic nerves; but the minute examination of modern anatomists has tracked them in great abundance."

Discussing the same point, Niemeyer[1] observes that: "Headache, a very frequent symptom in all cerebral diseases, is very difficult to explain; we do not even know if it is of central origin (that is, if it originates in the parts of the brain where irritation causes symptoms of pain after the insensible greater hemispheres have been removed), or whether, as I think is more probable, it depends on irritation of the filaments of the trigeminus going to the dura mater. The great sensitiveness to impressions on the senses depends on the increase of excitability, caused by the cerebral hyperæmia, or the hyperæsthesia of those portions of the brain through which peripheral irritations are perceived. The patients do not exactly feel, see, and hear more sharply than ordinarily, but they are annoyed by irritations far weaker than such as usually annoy them. Light troubles them; a slight sound or an insignificant irritation of the nerves of touch excites disagreeable feelings. Morbid excitation (which must not be identified with increased excitabil-

[1] "Niemeyer's Practical Medicine," Vol. II., p. 159, quoted by Day.

ity) of the same central parts causes the dazzling before the eye, seeing sparks, roaring and buzzing in the ears, the sensation of formication, or of undefined pain, which are not induced by peripheral irritation."

And again, Erb,[1] referring to the subject, feels compelled to admit that: "Physiology affords little aid in determining the sensory nerves in which the irritation is seated. Experiments upon the sensibility of different structures in the interior of the skull have given contradictory results; for whilst Leyden, Hitzig and Ferrier have found the dura mater to be highly sensitive, Pagenstecher ascribes a very low degree of sensibility to it, and Bartholow[2] who experimented on the human subject, found it to be but slightly sensitive to mechanical stimuli. The greater number of experiments seem to show that the pia mater is also not very sensitive, and the same may be said in regard to the greater part of the substance of the hemispheres. When Bartholow pushed his needles deep into the substance of the cerebral tissue, pain was only experienced in the neck after they had been pushed in to about the depth of the great ganglia at the base of the brain."

"We are unable, again, from physiological considerations to explain why headache should be experienced when the intra-cranial disease is situated in so many different parts of the brain or of its membranes; we must either admit that the tissues, which under ordinary circumstances are insensible or are only endowed with a low degree of sensibility, become sensitive under pathological conditions, and give rise to

[1] "Beard's Archives of Electrology and Neurology," New York, 1874, p. 68.

[2] "Diseases of the Peripheral Cerebro-Spinal Nerves," article "Cephalalgia," "Ziemssen's Cyclopædia," p. 138 et seq., 1876.

pain; or we may imagine that in diseased states the influence of pressure and irritation spreads to considerable distances, involving tissues that are sensitive. The dura mater may undoubtedly be included amongst such sensitive structures, since it receives sensory branches from the trigeminus and vagus; perhaps the nerves of the choroid plexus, which Benedict[1] has recently described, are of a sensory nature, and may be answerable for the 'internal' headache sometimes complained of. To what special locality, however, we should refer these 'nervous' headaches, is still undecided, and we can only offer guesses at the truth."

The most recent theory regarding the mode of production of pain along the course of nerves, as in neuralgia, is that promulgated by Prus.[2] According to this writer there are filaments in the sheaths of nerve-trunks, the irritation of which gives rise to the painful points found in neuralgic affections. These filaments, the presence of which was made known by careful microscopical examination, have received the somewhat ponderous appellation of *nervi nervorum periphericorum*. What part these structures are destined to play in the pathology of the future, experience alone can show.

As to the opinions entertained by myself with regard to the precise location and mechanism of these painful intra-cranial sensations, I can only agree with Niemeyer and Erb that the ground we tread upon is uncertain; and that, as far as deriving definite conclusions from anatomy and physiology is concerned, we are left somewhat in the dark. This much I will venture to affirm, however, that inasmuch as psychical

[1] Virchow's Arch. band 59

[2] Archives Slaves de Biologie, IV., 2 Sept, 1887. See also Brain, Vol. X., p. 557.

disturbances assuming the form of grief, worry and apprehension are of themselves quite capable of evoking severe intra-cranial pain, the latter is certainly in some manner due to cerebral agency. That such a connection must of necessity exist, is shown by the fact that when the disturbing psychical element is removed the pain frequently ceases instantaneously. To be sure such facts do not adequately explain the occurrence of the form of headache due to a variety of purely physical causes, but they are nevertheless eminently suggestive, since they are clearly instances of headaches evoked by forces operating solely by and through the brain.

On a superficial view, it would appear, then, that we meet with overwhelming obstacles on the very threshold of our investigation into the origin of these pains within the skull. The problem is, however, from a clinical standpoint at least, not so discouraging as it would appear at first sight; for, owing to the fact that we are acquainted with a considerable number of the factors concerned in the evolution of these pains, we are able to apply such knowledge to the practical ends of treatment. Again, although for the same reason, it is impossible to arrange the numerous varieties of headache upon the basis of their respective and ultimate pathological terms, we are at least able to classify the prominent forms of intra-cranial pain in accordance with their more obvious pathogenesis. Following this method, we may classify the various forms of headache as follows:

INTRA-CRANIAL HEADACHE.[1]

(1.) Anæmic Headache.

(2.) Hyperæmic or Congestive Headache.

[1] Nos. 3 and 5 are commonly known as "Sick Headache."

(3.) Nervous or Cerebral Headache.
(*a*) Cerebro-Hyperæmic Headache.
(*b*) Cerebro-Anæmic Headache.
(4.) Toxic Headache.
(5.) Sympathetic Headache. Bilious Headache, &c.
(6.) Headache dependent upon organic disease of the brain or its appendices.

EXTRA-CRANIAL HEADACHE.

(1.) Neuralgia, General Considerations on.
(*a*) Rheumatic Headache.
(2.) Osteal and Periosteal Headache.

CHAPTER II.

ANÆMIC HEADACHE.

The proximate cause of this form of head-pain is deficiency of blood within the cranial cavity. It is an almost invariable attendant on general anæmia and chlorosis, and consequently young women of feeble constitution are particularly liable to its attacks. The affection is not, however, restricted to any particular form of weakness, but, on the contrary, it is a common attendant on all forms of debility. Uterine hemorrhage, epistaxis, hæmorrhoids, mal-nutrition, chronic diarrhœa and over exertion both mental and physical may produce it. Masturbation in both sexes may give rise to it; and excessive indulgence in strong tobacco may cause it. One of the most prolific predisposing causes of the affection is morbid sexualism, as I have frequently observed both in married and single individuals.

Symptoms.—Sometimes those affected by this variety of headache complain of a sensation of tightness about the forehead, as though the head were encircled by a band. Sometimes again the pain is more restricted in character and manifests itself in clawing sensations, which are particularly well marked at the vertex. Whatever the location of the pain may be, it is almost invariably less pronounced when the subject is in the recumbent position than when the body is maintained in an erect attitude. Less pain is therefore felt during the latter part of the night and early

morning than during the day. In the more exquisite cases the simple act of rising is sufficient to cause vertigo and even syncope; indeed symptoms of giddiness and weakness in the lower extremities are almost constant accompaniments of this form of headache.

Sleep is also more or less affected, though during the day the subject is frequently beset by a morbid drowsiness which he endeavors to exorcise by the copious use of stimulants. The energy of the heart's action is reduced; and in very severe cases the venous murmur may be present in the neck as well as œdema of the ankles and of the legs. The latter condition is fortunately rare. Palpitations, extreme fatigue upon the slightest exertion and attacks of sudden fainting are frequently met with. The surface of the body and particularly the face are cold to the touch, and the countenance has a peculiarly blanched and waxy appearance. A morbid susceptibility to sensory impressions, particularly of light and sound, is present in most cases. The sensitiveness to light is often so great that the subject insists upon remaining in a darkened room during the day, while an artificial light of any kind is absolutely unendurable. The susceptibility to acoustic impressions of all kinds may also be abnormally increased, so that such trivial occurrences as the squeaking of a door, the rumbling of a cart, or ordinary conversation are absolutely unendurable.

The peculiar flaccid state of the heart, which is so characteristic of this condition, has been graphically alluded to by Dupuytren as "relâchement du cœur."

A symptom of considerable diagnostic importance is the feeble pulsation of the carotids—a phenomenon which is never absent in pronounced cases. Very slight pressure upon these arteries is sufficient, where the anæmia is severe, to provoke an immediate attack

of syncope. I first called attention to this symptom some time ago, and I have since had occasion to verify the assertions then made over and over again. The surface thermometer when properly applied over the vertex shows a considerable diminution in temperature as compared with the rest of the body. Again, persistent drooping of the eyelids is an almost constant symptom in this form of headache, and one of considerable diagnostic value, from the fact that the phenomenon may be produced experimentally by the appropriate application of compression to the carotids, as I have frequently demonstrated.[1]

Treatment.—The temporary relief of this form of headache is a matter of no great difficulty, especially if the cerebral anæmia is due rather to vaso motor than to general causes.

The inhalation of a few drops of the nitrate of amyl is often followed by immediate relief, but the latter is usually of only temporary duration, unless special means be adopted to perpetuate the good effects of the remedy. This object may be accomplished in a variety of ways: the inhalations of the nitrate may be repeated several times a day; the patient may be placed upon a sofa or bed, the foot of which is elevated by means of blocks of wood; alcohol may be given in frequent doses; the salts of iron and quinine may be administered, or opium may be given in small doses, a mode of treatment which has yielded good results in the hands of various practitioners in certain cases.

Of all the remedies above enumerated pre-eminent importance must be assigned to alcohol; when taken in moderate quantities it increases the energy of the heart's action and at the same time causes dilatation

[1] "Brain Rest," by J. Leonard Corning, G. P. Putnam's Sons. Also the various papers and articles alluded to in this work.

of the minute blood-vessels of the brain. It should never, however, be given in very large quantities, since when thus administered it causes depression of the nervous centres, besides exercising the most prejudicial effects upon the digestive and assimilative systems.

McLane Hamilton has found that the inhalation of nitrous oxide is of great benefit in anæmic headache. The ordinary apparatus used by dentists was employed in administering the gas.

The importance of maintaining a horizontal position, especially during the early stages of the affection, can hardly be overestimated; and the benefits thence to be derived may be greatly enhanced by elevating the lower extremities by means of cushions, or preferably by raising the foot of the bed or lounge by means of blocks placed beneath the feet.

After all has been said, however, with regard to remedies, it must be admitted that the ultimate reliance of the physician consists in enhancing the powers of the apparatus of digestion and absorption. Cod-liver oil, rare beef-steaks and mutton-chops should occupy a prominent place in the dietary; while milk and eggs may be given *ad libitum*, where the digestive powers are not seriously impaired.

As a matter of course, if the anæmia be due to the presence of some obviously morbid element, the latter should be gotten rid of as soon as possible. If the digestive apparatus is impaired it should be put in good condition as soon as possible; if there is hemorrhage from the uterus or any other portion of the body it should be arrested, and in short from whatever source the debilitating influences emanate, they should be neutralized or removed as expeditiously as circumstances will admit.

CHAPTER III.

HYPERÆMIC OR CONGESTIVE HEADACHE.

Symptomatology.—In this form of head-pain the subject complains of a severe tensive pain, and at the same time experiences a sensation of fullness, as though the cranium were too small for its contents. As a rule the painful sensations are not circumscribed in character, but are distributed throughout the entire extent of the cranium. The pain is constant, and is augmented by assuming the recumbent posture; consequently sleep is more or less profoundly affected. All forms of mental or physical exertion are followed by exacerbations of pain accompanied by more or less vertigo. The subject is extremely irritable and aroused to inordinate passion by the most trivial circumstances; he is pessimistic, depressed and lachrymose, and inclined to find fault with all about him. Sensory disturbances are also more or less common, and may consist in functional exaltation or depression.

Sometimes the action of the heart is inordinately increased in strength and considerably accelerated, so that the patient complains of throbbing in the temporal and carotid arteries, which in some cases is so violent as to be easily discovered with the naked eye.

There is also a well-marked increase in temperature, particularly above the vertex, and the face is suffused to such a degree as to present a livid, coppery appearance.

Causation.—The immediate cause of the above group of symptoms is an increase in the arterial blood-

tension, accompanied by more or less relaxation on the part of the cerebral capillaries. A somewhat similar series of phenomena may, however, be evoked by distension of the intra-cranial veins consequent upon some form of obstruction to the flow of blood in the same (passive congestion). When the impediment is serious, coma may be induced. Vaso-motor insufficiency, especially that affecting the intra-cranial circulation, is a prolific cause of the congestive form of headache; it may result from the most varied causes, and is especially prone to occur as the consequence of excessive sexualism and the protracted abuse of alcoholic stimulants. To enumerate all the pathological conditions which may give rise to this form of headache would, however, involve the recapitulation of a considerable segment of special and general pathology, and would, of course, be supererogatory in a work of this kind.

Treatment.—Without doubt the most expeditious mode of affording relief in uncomplicated cases of congestive headache—those which are attributable to abnormal heart or vaso-motor conditions, or both—consists in the skillful application of compression to the common carotid arteries[1] by means of appropriate instruments. Electro-compression[2] also yields excel-

[1] "Prolonged Instrumental Compression of the Primitive Carotid Artery as a Therapeutic Agent," by J. Leonard Corning, M.D., "New York Medical Record" for Feb. 18th, 1882. Also article in "Philadelphia Medical News," for June 17th, 1882; this article may also be found in the "American Journal of Neurology and Psychiatry," 1882. See also, "Carotid Compression," Anson D. F. Randolph & Co., New York, 1882, Ibid. "Brain Rest:" A Disquisition on the Curative Properties of Prolonged Sleep, by J. Leonard Corning; M.D., G. P. Putnam's Sons, New York, Second Edition, 1886.

[2] For the original paper on the combined application of com-

lent results, especially in those cases where the adipose covering of the neck is of such thickness as to render the application of strong pressure without implication of the jugular difficult or practically impossible.

Of the two procedures electro-compression will on the whole be found most effective and universally applicable. As some of my readers may not be familiar with the rules which I have elsewhere given for carrying out this mode of treatment, I will give the salient points involved.

MODE OF EXECUTING ELECTRO-COMPRESSION.

For applications of short duration, and these are the most uniformly useful in the treatment of congestive varieties of headache, I have found the following device convenient: It consists in the first place of two curved metallic branches, resembling in shape an ordinary horse shoe. To each of the extremities of these branches is attached a small sponge electrode. These electrodes are insulated by means of hard rubber plates. To each of the electrodes is attached a conducting cord. These cords unite in one common stem, which being secured to the binding post of a galvanic battery renders the polarity of the two sponge electrodes the same. (Fig. 1.)

It is possible by means of a screw provided with a detachable key to place the electrodes at an angle. The object of this device is to enable the operator to exercise pressure upon the carotids in an oblique direction, so as to press them away from the jugular veins

pression and electricity, see "Electrization of the Sympathetic and Pneumogastric Nerves, with Simultaneous Bilateral Compression of the Carotids," by J. Leonard Corning, M.D., "The New York Medical Journal" for February 23d, 1884.

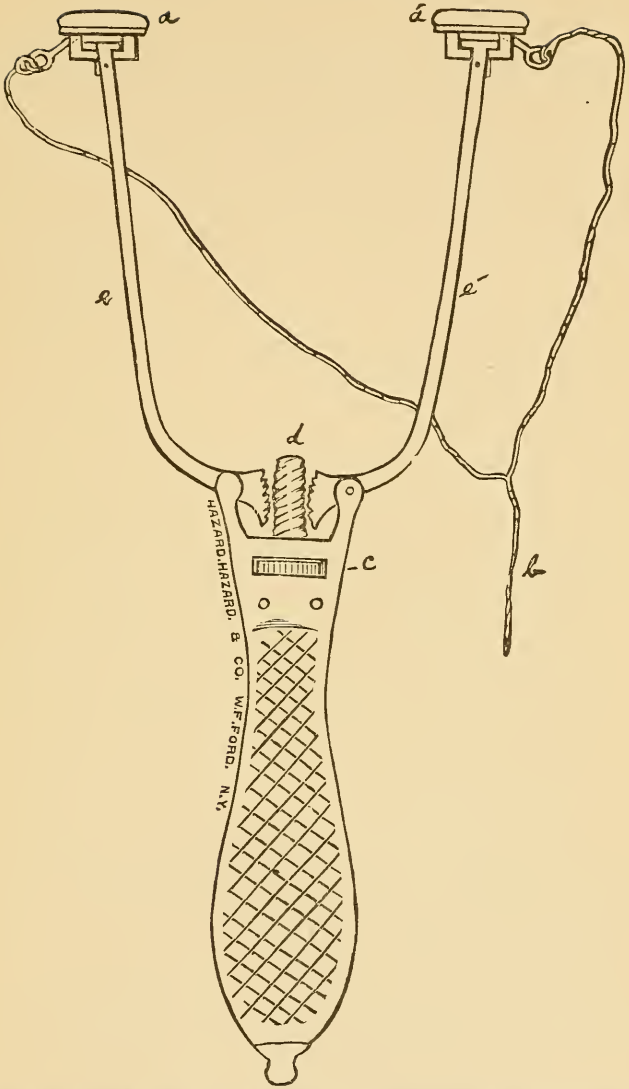

FIG. 1.—AUTHOR'S ELECTRO-COMPRESSOR.—*a a'*, insulated sponge electrodes in connection with the bifurcated conducting wire *b*; *c*, milled wheel, the rotation which causes the screw *d* to act upon the armatures *e e'*, thus enabling the operator to expand or approximate the latter at will.

in the direction of the spinal column. By this means it is possible to reduce venous pressure to a minimum. Again, the branches themselves may be extended or approximated at will, an advantage obtained by the use of the Archimedean screw. An exceedingly fine adjustment is thus rendered possible.

The method of employing the instrument just de-

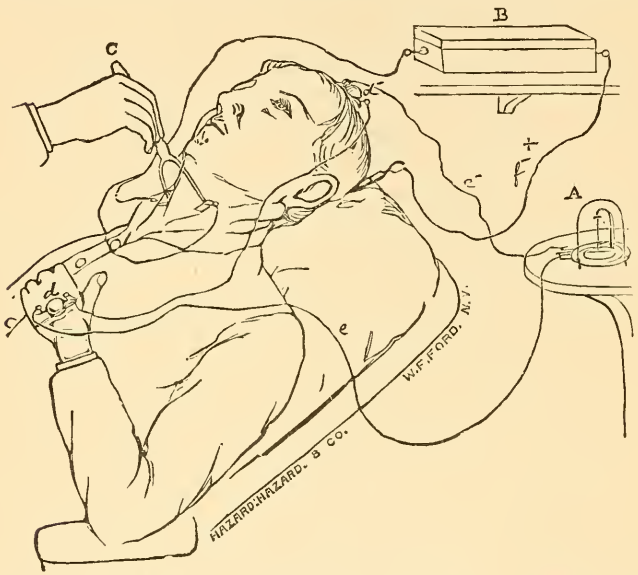

FIG. 2.—SHOWING MODE OF APPLYING ELECTRO-COMPRESSION. A, differential calorimeter, connected with the thermo-electric piles *d d*, by means of the conducting wires *e e'*. B, galvanic battery connected with the electro compressor C by means of the bifurcated conducting wire *f*. The electrode at the extremity of the other conducting wire *f'* is placed on the neck.

cribed is exceedingly simple. The patient, if in bed, is placed in a horizontal and semi-dorsal position, with the head supported by a cushion beneath the neck, in such a manner as to allow the head to fall slightly backward, while the cervical vertebræ are protruded anteriorly (Fig. 2). The operator then takes his place

by the bedside, his left side being turned toward the patient. Then, having with the index-finger and thumb ascertained by careful exploration the exact position of the carotids, he proceeds, after accurately adjusting the armatures, to apply the instrument in such wise that the electrodes will press the arteries away from the pneumogastric nerve and jugular vein in the direction of the spinal column.

In applying the instrument it should be held in the right hand, the handle forming a perpendicular to the arteries. By pressing the left hand firmly against the posterior portion of the neck, the operator is enabled to execute any counter-pressure which may be required, and at the same time to contribute to the support of the head in the desired position. Compression should, however, never be carried so far as to cause entire closure of the lumina of both arteries; such a procedure may cause convulsions, as the anastomotic facilities at the circle of Willis are usually unequal to these unwonted circulatory exigencies. This contingency is, however, not liable to arise, as the degree of pulsation in the temporal arteries affords reliable information as to the extent of the circulatory obstruction.

When the instrument has been properly adjusted, an assistant applies the disengaged electrode (usually the positive) over the posterior aspect of the cervical vertebræ.

All being in readiness, the strength of the battery is gradually increased.

It is impossible to determine in advance how many cells may be required, as this will depend greatly upon the strength of the battery, the thickness of the cervical adipose tissue, and the degree of compression employed. The greater the amount of compression the

less the strength of the current should be, and *vice versa.*

Care should be exercised to avoid dizziness or syncope, and the strength of the current and degree of pressure should at all times be regulated with the utmost nicety. Sudden variations in either of these factors are to be carefully avoided. By this mode of treatment we accomplish a threefold end: (1) Diminution of the amount and pressure of the cortical blood-stream; (2) Contraction of the cerebral capillaries; and (3) Reduction of the intensity of the heart's action (when currents of considerable strength are employed).

I have frequently caused entire cessation of the congestive form of head-pain in the course of from five to eight minutes by the use of this method of treatment.

Only secondary in importance to the above method of treatment is the application of cold to the head. This may be done by means of the ice-bags in general use, or better still by the employment of the apparatus recommended by Mr. Joseph Leiter, Dr. Knowsley Thornton and others. This appliance consists in a series of india-rubber spirals, which are wound around the head in the form of a cap. By passing a stream of cold water through these spirals it is possible to maintain the water in them at an exceedingly low temperature. This method of treatment has been extensively employed, I believe, by Mr. Spencer Wells of London, especially after the operation of ovariotomy.

This ice-water cap may be employed with increased benefit in conjunction with hot water both to the feet and calves; the effects thus attainable being striking.

Hot baths to the entire body ranging in temperature from 103° to 110° may be prescribed with advantage, where other means of treatment are not accessible.

Baths of this character affect the central nervous system to a much greater extent, and in a shorter space of time than warm baths. The skin becomes rapidly congested; respiration is increased and inspiration becomes deeper. As a rule these baths are followed

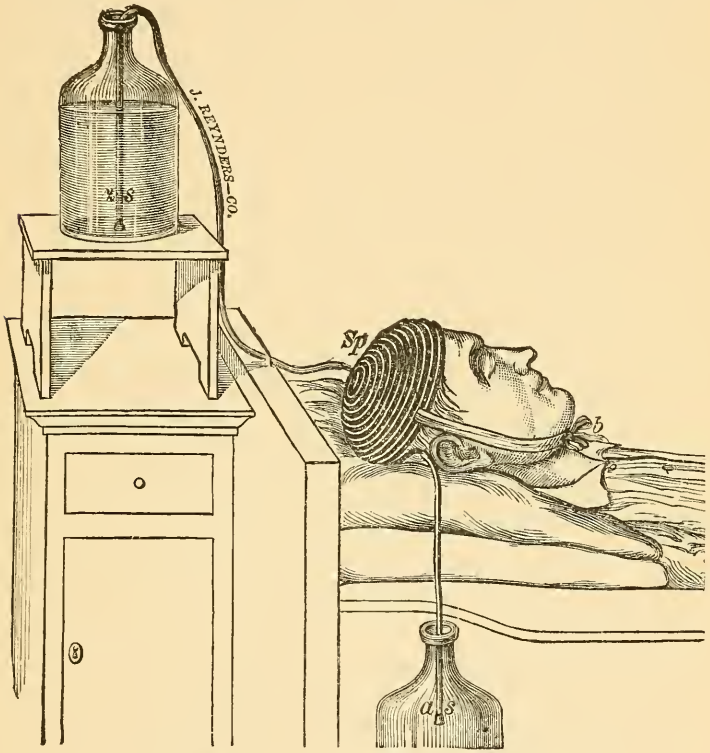

Fig. 3.—Mode of Applying Ice-water Cap. (After *Leiter.*)

by profuse perspiration, and their derivative action upon the engorged cerebral centres is not to be overestimated.

The hot-air or Turkish bath has a wide application in the treatment of the congestive form of headache;

and I have no hesitancy in recommending its employment in this connection, though fully aware that a prejudice exists against the use of hot baths in brain affections. The sojourn of the patient in the hot-room should not, however, be of too long duration ; twenty or thirty minutes are quite enough. When possible, the subsequent application of the douche should be in the form of the hot water stream, as recommended by certain French physicians, in order to redden the skin, especially about the back and lower limbs. As soon as this operation is completed the patient should be put to bed and wrapped in warm blankets.

A most excellent expedient, in severe cases, is the application of a leech at each side of the septum narium, about half an inch above the nares. This may easily be accomplished by the aid of a curved leech glass. The hemorrhage which follows is sometimes profuse, but may be arrested by the application of a tampon of styptic cotton on each side of the septum. In order to increase the bleeding, it is only necessary to hold the head over a bowl of hot water.

Should the hemorrhage from the mucous membrane prove obstinate, the application of a solid point of nitrate of silver over the bite may be resorted to. It is hardly necessary to add that, in the application of leeches to the septum, care should be taken to prevent the passage of the animals into the nasal cavity. This may be accomplished by previously plugging the nostrils with cotton wool. In order to avoid the employment of leeches, I have had constructed an apparatus, by means of which artificial epistaxis may be produced in a satisfactory manner, and without the slightest possibility of accident.

It consists, in the first place, of the jar (*e*), which is connected with the air pump (*h*), by means of which

it is possible to cause a vacuum in the vessel (*e*). The gauge (*f*) registers the degree of approach to a vacuum. An india-rubber tube connects the jar with the small bottle (*c*), which is provided with a scale. A bifurcated tube (*b*) connects the bottle with the two small cupping bowls (*a a'*) ; the latter are sufficiently minute to admit of their introduction into each nostril respectively. As they are provided with india-rubber garnitures, it is possible to adapt them accurately to the sides of the septum.

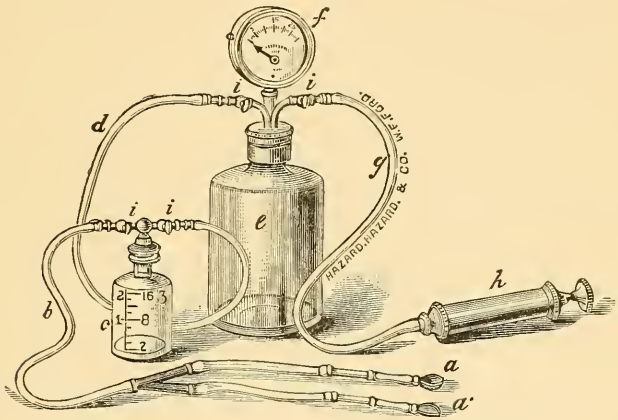

Fig. 4.—Author's Apparatus for Artificial Epistaxis.

The mode of employment is simple enough. The cupping bowls having been introduced, a small scalpel is inserted in turn beneath the edge of each, by means of which the mucous membrane of the septum is slightly scarified. The cupping bowls are then connected with the vacuum jar and with the bottle by opening the appropriate stop-cocks. These valves (*i*, *i*, *i*, *i*) require no explanation, as their function is self-evident from the situation which they occupy. Short segments of glass tubing, inserted in

the india-rubber pipes below the cupping bowls, enable the operator to observe whether the blood is flowing properly, or whether further scarification is necessary. As the blood flows into the graduated bottle already described, it is possible to determine with accuracy the amount removed.

Blisters to the nape of the neck and sinapisms to the calves of the legs have been highly praised by some as adjuncts to other modes of treatment; while the scarification of the nape of the neck has also found advocates.

The application of the constant galvanic current to the head is a useful expedient in some cases, but too much reliance should not be placed upon it.

On the other hand, dry-cupping when extensively practised is sometimes attended with happy results, especially in the milder forms of congestion. A very good method for carrying out this form of treatment is to smear the posterior portion of the neck and the back throughout its entire extent with spermacetti ointment; the exhaust glass (which should be large) is then repeatedly applied and voided by means of the air pump. This procedure is repeated until the entire back becomes livid. It is evident that such a degree of superficial congestion must exercise no little derivative action upon the deeply seated tissues; and indeed the results obtained in cerebral and other forms of congestion are sometimes all that could be desired. Where the engorgement is very considerable, however, it is usually necessary to resort to some one of the more powerful remedies already referred to. Venesection, to which resort was had by the older physicians in congestion and other forms of headache, can only meet with unqualified condemnation by the modern neuro pathologist as at once a supererogatory and even dan-

gerous procedure. Local depletion by epistaxis—the most direct mode of affecting the cerebral circulation by blood-letting,—or compression of the carotids by means of appropriately constructed instruments, are certainly far more direct in their effects than general depletion, and at the same time quite devoid of danger or disagreeable consequences of any kind.

CHAPTER IV.

NERVOUS OR CEREBRAL HEADACHE.

Under this designation I propose to consider that variety of headache which, in its typical form, is characterized by the absence of all circulatory derangements and neuralgic symptoms. The most logical supposition relative to the pathology of this form of headache is that which ascribes the painful phenomena to certain subtle morbid changes originating in the substance of the nervous centres themselves. To be sure, we have no further proof of the truth of this hypothesis than that afforded by the fact, that this variety of headache may be readily evoked by profound emotional disturbances — factors which appeal directly to the psychical centres—in the absence of all purely physical causes, such as neuralgia or derangements of the intra-cranial circulation. Neither this nor any other theory relative to the nature of the affection can, however, be accepted as in any sense final.

Unlike the anæmic and hyperæmic varieties of headache, the form of the affection which we are considering is not readily amenable to experimental investigation, and hence, as already intimated, we are reduced to the necessity of forming our conclusions from data which, to say the least, are insufficient. Pending more exact knowledge, however, the theory which ascribes the phenomena of the affection to some subtle disturbance in the cerebral substance may be accepted; and it may also be added that this hypo-

thesis will be found to lead to a thoroughly enlightened and effective practice.

Symptoms.—In many persons the onset of the headache is marked by the occurrence of digestive derangements in the form of eructations, flatulency, or constipation. There is always more or less malaise and mental irritability in the beginning, and the latter symptoms usually become greatly exaggerated in the course of a few hours.

The pain begins in some persons with a certain amount of visual disturbance; the sight becomes clouded, and at the same time an acute pain is felt in the corresponding temple. With these symptoms the patient usually experiences more or less nausea, confusion of ideas and vertigo; while, at the same time, his thoughts become concentrated on his real or anticipated misfortunes, with the result of greatly augmenting the intensity of the head-pains. Sometimes the pain is felt in the vertex, forehead or occiput; but in a considerable percentage of cases, it becomes located in one temple, in one-half of the head, or in one eye; so that the supposition may be formed that the nerves of the head are implicated, as in neuralgia.

There is also more or less sensitiveness to sensory impressions of all kinds; the patient shuns the light and stops her ears with pledgets of cotton, or with her fingers, in order to keep out the din of the house and street.

Sometimes the subject complains of feeling as though her eye were being forced out of the socket, or as though the side of her nose were being burned with a hot iron.

I have already mentioned the cerebro-hyperæmic and cerebro-anæmic varieties of headache, in the table of classification at the head of this article. It would be

an easy matter to discourse at length upon those modifications of the nervous headache, but to do so would be somewhat supererogatory, since, in their fundamental characteristics, they are closely allied to the latter affection. The only point of difference consists in the presence of certain vaso-motor disorders of the cerebral blood-vessels, which find their chief clinical expression in either pallor or flushing of the countenance and in diminution or increase in the strength of the carotid pulse. These circulatory phenomena are, however, strictly speaking, purely secondary to the primary morbid changes in the cerebral substance. It is well to bear this fact in mind, since, if the efforts of the physician be directed solely toward the modification of these vascular changes, he will inevitably meet with disappointing results. On the other hand, if appropriate efforts be made to remove the primary condition of irritability, resident in the cerebral substance itself, good and even brilliant results may often be obtained in a comparatively short period of time.

Causation.—The most potent predisposing element is undoubtedly found in the neurotic and impressionable constitutions of the patients, or their ancestry. Debilitating diseases, spermatorrhœa, leucorrhœa, mental disorders, and profound digestive disturbances may also predispose to the occurrence of the nervous or cerebral form of headache.

Among the exciting causes, worry, disappointment, pecuniary losses, and in short the whole category of depressing emotions occupy the most prominent position. Only secondary to these in importance is exhaustion of the nervous centres, particularly those of the brain.

Treatment.—The point of paramount importance is to calm the irritable nervous centres. This is best ac-

complished by the administration of remedies which exert a soothing influence upon the cerebral parenchyma, and at the same time tend to promote sleep. To this end, I usually administer the bromides in ten, twenty or even thirty-grain doses, where the stomach is sufficiently tolerant, and follow these remedies with a hypodermic injection of from one-eighth to one-sixth of a grain of morphia. At the same time, the patient being secluded in a dark room, ice is applied to the head—a procedure often followed by excellent results, especially if there be some tendency to cerebral congestion.

On the other hand, if the face is bloodless and the conjunctivæ are pale, the hot-water bag is indicated, and should be resorted to at once. The question as to whether the elastic band [1] should be applied above the superciliary arches, will depend greatly upon whether there are any concomitant neuralgic symptoms or not. Where these are present, the pressure caused by the band is usually not well borne, and consequently this otherwise useful adjunct to treatment is contra-indicated.

If sleep is not readily produced by the remedies above indicated within a reasonable length of time, hyoscyamus may be prescribed. I usually give it in the form of tincture in drachm doses, either alone or combined with the bromides. Chloral has been recommended in nervous headache by some writers, but is not to be compared with the hypodermic injection of morphia.

If the subject, as not infrequently happens, is averse

[1] The object of the elastic head-band is to compress the vessels of the scalp, thereby materially reducing the diffusive influence of the extra-cranial blood stream, and rendering the effects of cold or hot applications upon the brain much more intense.

to its subcutaneous exhibition, it may be given in the form of suppositories, but the effects thus obtainable are not always as striking as those witnessed when the remedy is injected beneath the skin.

If there is pain over the temple or in the eye, and if the subject complain of "soreness in the teeth" and neuralgic pains in the face, it is well to make the injection in the neighborhood of the painful district, though this is considered unnecessary by some authors.

It is sometimes stated that, while morphia is very efficacious at the beginning of the attack, it is of less value after the headache has continued for some time. My own experience does not corroborate this statement; and I have not the slightest hesitancy in stating that, previous to the introduction into practice of antipyren, this remedy was the one upon which I based a goodly portion of my hopes whether the patient was seen after the pains have become established, or at their very inception.

The aim of the physician, when brought face to face with a severe case of nervous headache, should be to afford relief, and that as speedily as possible; indeed it is almost impossible to overestimate the suffering incident to one of these attacks; and the confidence and gratitude inspired by prompt and succesful treatment are a source of lasting satisfaction to physician and patient alike. On the other hand, want of success brings mortification, if not permanent loss of professional prestige. If possible, it is well to see the patient towards evening, when the soporific tendency consequent upon habit is greatest.

As soon as a diagnosis has been made, antipyren may be exhibited in doses of fifteen grains every twenty minutes during the first two hours. The bromides may then be given — preferably in a dose

of from twenty to thirty grains in conjunction with one drachm of the tincture of hyoscyamus. Should there still be persistent pain the eighth of a grain of morphia may be injected beneath the skin. Sympathizing friends should then be sent away, and the patient allowed to remain quiet in a perfectly dark room, while the medical attendant occupies a neighboring apartment, leaving the door ajar. If in due course of time the patient fall asleep, the attendant may depart, resting assured that on the following morning there will be improvement, if not absolute cure. Should sleep, however, remain absent after these first endeavors, there should be no hesitancy on the part of the physician in resorting to a further hypodermic injection of morphia, even though there be nausea and a tendency to vomit. Usually, though not always, the nausea may be controlled by giving half a grain of cocaine in a teaspoonful of water just previous to making the injection. I make it an invariable rule never to leave the patient until sleep has been produced, as the therapeutic effects of eight or nine hours of unconsciousness are simply marvellous in these cases. Sleep, indeed, is the grand objective point of all treatment, in so far as the realization of permanent cure is concerned. Its skillful induction in the cases which we are considering will often procure the physician lasting gratitude, with the advantages which naturally follow.

CHAPTER V.

TOXIC HEADACHE.

This form of headache is caused by some chemical change in the constitution of the blood, due either to poisonous substances introduced into the system from without, or evolved in the economy itself through the agency of some organic or functional derangement.

The best instance of the first named condition is the headache due to alcoholic poisoning; while the head-pains of Bright's Disease and of fevers, are examples of the effects produced by septic influences arising from morbid processes within the organism itself.

Symptoms.—The nature of the pains arising from toxæmic causes is variable in character. Sometimes the subject complains of a heavy, dull sensation in the head, which may or may not be accompanied by vertigo. Again, the pain is sharp, and is described as splitting or boring. This is the form of headache described by Fournier;[1] it is frequently met with among other phenomena of secondary syphilis.

According to the extent of the intoxication, the faculties of the mind are more or less affected. There may be delirium as in violent febrile disturbances, or the only symptoms noticed are heaviness and slight mental confusion, as in the headache resulting from inhalation of carbonic acid gas.

The latter form of headache is frequently met with among the school children of Germany, who, owing to

[1] Fournier, "Leçons sur la Syphilis," Paris, 1873.

the defective ventilation of educational institutions, are compelled to breathe the same air over and over again. The prejudicial effects of such bad hygienic arrangements are not alone confined to the central nervous system, but are visible in other departments of the economy as well. Facial pallor, baggy muscles and permanent interference with the processes of growth and physical evolution are some of the penalties which are the inevitable result of flagrant disregard of the most ordinary sanitary laws.

Among workers in brass and chemical manufactories a dull, heavy, persistent form of headache is frequently encountered, which is evidently the result of the noxious fumes such persons are compelled to inhale during a considerable portion of each day.

Chronic lead poisoning frequently gives rise to headache of an aggravated and persistent type, and the same may be said of the toxic effects of a large number of other substances, such as the noxious gases already alluded to, narcotics, and alcoholic stimulants.

Uræmic intoxication is another and common source of headache. The secretory power of the kidneys becomes impaired by reason of the destructive inflammatory changes incident to chronic diseases; the excrementitious matters of the blood accumulate, and their presence is manifested by disturbances of the central nervous system—headache, drowsiness and coma. Every physician is acquainted with cases of this kind, and nothing more need be said regarding them, except that the headache in question is often an early warning of renal trouble.

Treatment.—When the headache is the result of the introduction of some noxious substance into the system, every effort should be made to eliminate it from the economy. The bowels should be opened; diuretics

should be given, and the secretions of the skin stimulated by appropriate diaphoretics.

Buckthorn (rhamnus), a purgative which I have found most useful in asylum practice, is particularly applicable in this variety of headache ; it may be given in the form of the fluid extract, in doses of from one to two drachms. The fluid extract of aloes may also be given, but I prefer the buckthorn. Whatever the purgative employed it should be fluid in form, in order to obtain as speedy action as possible.

Pilocarpin is useful, but I prefer the Turkish or Russian bath.

If the headache be the result of some form of constitutional disease, such as syphilis. it is evident that the efforts of the physician should be directed to the primary affection. The same may be said of the headaches of fevers and kidney affections. It is clear, from these cursory remarks, that the proper treatment of this form of headache requires no little insight and tact on the part of the medical attendant. To attempt to deal with such cases by the aid of any stereotyped procedure would avail little; and to lay down any such arbitrary laws on the subject, would be but a lamentable confession of pedantry.

CHAPTER VI.

SYMPATHETIC HEADACHE, BILIOUS HEADACHE.

This is a very common though obscure form of headache, being dependent upon eccentric sources of irritation. Any disease of the peripheral organs may cause it. Ovarian or uterine affections, hemorrhoids or decayed teeth may give rise to it; but its most prolific cause is undoubtedly found in the manifold digestive disturbances, to which those of feeble constitution are liable. It would be a mistake, however, to imagine that the sole explanation of its origin is to be sought in peripheral disturbances alone, though these undoubtedly constitute the exciting factor. A certain impressionability of the sensorium, such, for example, as that exhibited by neurotic young women, is essential, in order that the irritation proceeding from a distance shall culminate in the production of the painful sensations.

All kinds of hypotheses have been advanced in explanation of these curious head-pains; the most universally accepted is that which assumes that the peripheral irritation becomes manifest in the brain through the agency of the pneumogastrics and sympathetic system of nerves. Quite an array of clinical facts might be advanced in support of this theory; but to maintain its integrity by the aid of experimental physiology is, in the present state of knowledge, not so easy a matter. Still, some theory is better than none at all, and pending further researches, the opinions cur-

rently advocated may be accepted. Nor need this course cause apprehension, since the theory itself is a good guide, as far as actual practice is concerned, and can only lead to enlightened treatment. Of the latter point I shall take occasion to speak presently.

As to the *Symptoms* themselves, very little particularization is necessary. Sometimes the pain is local in character and may manifest itself in a sensation of fullness or constriction about the forehead, or it may be of a rasping, clawing nature, confining itself to one lateral half of the head or to the region of the vertex.

As a rule, the painful sensations are aggravated by stimulants; but this is owing, in part at least, to the digestive disturbances which so frequently constitute the exciting cause of the affection. That form of headache characterized by the presence of a yellow skin, by the accumulation of bile in the duodenum, and by more or less imperfect digestion, has received the designation of "bilious headache." There is every reason, however, to regard this variety of head-pain as of purely sympathetic origin, since the headache comes on after the digestive disturbances have become established, and disappears as soon as they have been removed. It is a matter of common experience, moreover, that the "sick" headache which supervenes upon minor gastric disorders is frequently relieved immediately by vomiting.

True bilious headache is more common among men than among women, on account of the excesses of the table committed by the former.

The pain may begin after any meal, but is more common after a hearty evening dinner than after lunch or breakfast. Sometimes, however, the headache begins in the morning as the result of a previous nocturnal debauch, and renders the subject entirely unfit for

the duties of the day. The head may be hot or cold, but whatever the vascular conditions they are secondary to the cerebral irritability which is the factor of prime importance. If vomiting takes place spontaneously or by the aid of emetics, the relief experienced is often magical. When, however, the gastric and cerebral disturbances have persisted for a considerable length of time, the consequent irritability and exhaustion of the nervous centres is so great that the only chance of relief is more or less prolonged unconsciousness. Under these circumstances, sleep is certainly the remedy *par excellence;* and to procure it, resort should be had to hypodermic medication alone, as the introduction of remedies into the inflamed stomach is usually followed by vomiting, or at least great discomfort.

Treatment.—The control of a single attack is, as we have seen, a matter of no great difficulty. To finally vanquish and definitely suppress the exciting cause of these paroxysms is, however, a task of greater magnitude. It involves in many cases nothing less than the removal of dyspeptic and other gastric difficulties of long standing, and the tranquilization of a morbidly irritable nervous system. The first portion of the problem requires for its solution the manifold resources of general medicine. As to the suppression of morbid irritability of the nervous centres, all that has been said on the subject in the paragraph on cerebral or "nervous" headache applies here with equal force. I will only add that the preparations of coca often prove exceedingly useful in treating this form of headache. This is partly due to the anæsthetic effect of the drug upon the irritable gastric mucous membrane; and in part to the tranquillizing influence exercised by the coca upon the higher cerebral centres.

As all practitioners are aware, one of the most disagreeable features connected with the treatment of this form of headache consists in the intolerance of the stomach to remedies. Until the introduction of the coca preparations into practice, I was frequently at no little loss as to the pursuit of a consistent plan of medication in such cases, owing to this same intolerant condition of the stomach. I soon ascertained, however, that by adding a certain quantity of the fluid extract of coca to the remedy that I was anxious to prescribe, the latter was borne with much less inconvenience. The good effects thus attained were greatly enhanced by the addition of half a grain of cocaine or more. This was particularly exemplified in those cases where I had occasion to prescribe considerable quantities of the bromides. A pill compound of: Res. Podophylli gr. ½, Extr. Col. comp. pulv. gr. 1, Extr. Hyoscyami gr. ¼, Hydrarg. Chlor. mit. gr. 1, is an excellent cathartic where brisk action on the liver is desired. The addition of a small quantity of the extr. of belladonna is advisable where the tendency to griping is pronounced.

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The following formula, recommended by Day, sometimes renders good service where there is a tendency to flatulence and acidity:

℞ Sodæ Bicarb.
Bismuth Subcarb.
Pulv. Acaciæ, āā. . . ʒ j.
Spt. Amm. Arom., . . ʒ ij.
Sqr. Zingib., . . . ʒ iij.
Aquæ puræ, ad. . . ℥ viii.

Two tablespoonfuls three times a day half an hour before eating. Here also the efficacy of the prescription is greatly enhanced when its administration is

preceded by giving cocaine hydro-chlorate, half a grain in a teaspoonful of water. I have tested this point many times, often in exceedingly intractable cases.

Bismuth in doses of from fifteen to twenty grains before meals may be given where there is evidence of intestinal irritability.

Sometimes two or three drops of the tincture of nux vomica given every half hour for three or four hours renders good service.

An excellent expedient is that of Dr. A. A. Smith,[1] who gives half a drachm of saccharated pepsin in a wineglassful of sherry three times a day at meal times. A drop or two of the tincture of aconite, given in a small quantity of water and repeated at intervals, sometimes proves efficacious where the pulse is small and rapid.

Where the extremities are cold the application of hot-sand bags, which have previously been covered with flannel, proves beneficial by equalizing the circulation and promoting the general comfort of the patient. Quinine may also be given when there is a suspicion of malaria, or when there is pronounced facial pallor and weak carotid pulse; but should there be the slightest suspicion of cerebral congestion it should be withheld.

[1] A lecture delivered at the Bellevue Hospital Medical College. "The Medical Record," September 15th, 1876.

CHAPTER VII.

ORGANIC HEADACHE, OR THAT WHICH IS DEPENDENT UPON PROFOUND CHANGES IN THE CONSTITUTION OF THE BRAIN OR ITS MEMBRANES.

THE consideration of this variety of head-pain does not strictly speaking belong in a work of this character. For the sake of differential diagnosis, however, a word or two respecting its more important characteristics will be found of service.

Headaches due to organic disease of the brain are usually more or less continuous in character and are referred to a circumscribed portion of the cranium. There may or may not be accompanying disturbances of sensation and motion assuming the form of local spasms, paresis or impairment of vision.

Sometimes cases are encountered in which progressive loss of muscular power, vertigo, visual impairment and derangement of the faculty of recollection are the prominent symptoms. If headache, accompanied by epileptic phenomena, disturbances of speech and facial paralysis, takes place at the period of adolesence, there is strong presumptive evidence that we have to do with organic disease, more especially if a history of previous syphilis is forthcoming.

The probability that a correct diagnosis has been made is considerably enhanced if there is vomiting and inability to retain food on the stomach, in the absence of obvious gastric disturbance.

Organic disease is by no means as frequent a cause of headache as might be imagined from the percentage of gross cerebral lesions. Nor is the diagnosis of this form of headache always an easy matter. Sometimes the headache resulting from organic changes may be circumscribed in character and located by the patient with great precision; whereas a subsequent *post-mortem* examination may prove such localization to be entirely subjective, the lesion being found in an entirely different portion of the brain. Again, there may be more or less profound organic changes without headache; or there may be intense local pains, more or less persistent in character, and which are wholly due to some circulatory instability.

In the face of such facts, it is evident, that only by the exercise of the utmost caution is the liability of error to be reduced to a minimum.

Causes.—The lesions which are most liable to give rise to this form of headache are: arterial disease, syphilitic and other varieties of tumor, tuberculosis, cerebral softening, hydatids and ossified formations within the cranial vault and meningitis.

Treatment.—The treatment of headache due to organic lesions of the intra-cranial structures is in the highest degree unsatisfactory, as far as the prospect of ultimate recovery is concerned. This at least is true as regards non-syphilitic lesions. Where there is reason to believe that the disturbances are due to the presence of syphilis, the iodide of potassium should be given in large doses two or three times a day, and the treatment persisted in until improvement becomes evident. Sometimes there is no apparent benefit in the beginning; but this should not deter the practitioner from persevering in the only course which offers the slightest hope of ultimate amelioration.

And it must be confessed that great patience will be required, both on the part of the patient and physician, in order to withstand the lack of success which frequently attends the beginning of this heroic medication. Sooner or later, however, if the lesion be really due to syphilis, improvement may occur, and the spectacle of the patient's improvement under such unpromising circumstances is an ample reward for all previous anxiety.

The iodide of potassium has been recommended as efficacious in the treatment of non-syphilitic tumors, as well as in those traceable to specific influences. I cannot say that the bulk of clinical evidence accessible up to date goes far to confirm this opinion; but in spite of this fact, it is evident that the iodide should always be given a fair trial in all doubtful cases.

As to the treatment of the pains themselves, morphine is unquestionably the remedy upon which the greatest reliance is to be placed. There is one drawback to its administration, however, the serious depression which it sometimes produces in neurotic, irritable subjects. This collateral disadvantage is best overcome by the administration of one of the coca preparations,—either the extract or Mariani's coca wine. I usually give the latter in wineglass doses as soon as there is the slightest tendency to depression. The amount of morphine required is of course exceedingly variable; usually, however, one-sixth of a grain will be found to render good service, especially if followed by a drachm of the tincture of hyoscyamus, or ten grains of chloral. The latter remedy when given alone or in conjunction with the bromides usually fails to render substantial aid; and I would therefore insist that opium in some form be invariably given previous to the exhibition of the chloral preparations. Anti-

pyren has not helped me much in this class of cases, when given alone. In conjunction with small doses of morphine, however, I have seen good results follow its exhibition.

CHAPTER VIII.

CASES.

Having in the preceding chapters discussed the principal phases of headache, it may perhaps prove of benefit to cite a few illustrative cases:—

T. B., a merchant, native of St. Kitts, West Indies, was referred to me by the late Dr. Cornelius R. Agnew, on account of severe headaches, accompanied by certain mental disturbances, such as temporary loss of memory and lassitude.

Patient had already consulted several eminent English authorities, among whom I believe was Sir Andrew Clarke. When I first saw this gentleman in November, 1886, he exhibited the following symptoms :

Periodic exacerbations of cerebral hyperæmia, accompanied by tensive pains and sensations of fullness in the head. Sometimes there is vertigo; at others the patient, though ordinarily of an even disposition, is irritable and aroused to worry and fretfulness by trivial or imaginary causes.

The heart's action is also more or less increased during the attack. During the head-pains the face is suffused, whereas at other times his complexion is of a yellowish grey appearance.

Patient has suffered from constipation for many years, and of late his venereal functions have exhibited a well-marked decline.

I prescribed purgatives and the bromides, with

directions to take a hot bath as soon as the first symptoms of an impending attack should make their appearance. While sitting in the bath, the warm water extending up to his arm-pits, I instructed him to press upon his carotid arteries with an implement which I loaned him for the purpose. These simple measures never failed to give him instant relief. On one occasion he had a slight attack of syncope while in the bath, and the attendant, who was always present, removed him at once. There were no further evil effects from the treatment that I ever heard of, nor do I believe that this slight syncope need have occurred had the patient obeyed my injunction not to remain in the bath more than ten minutes, which for a man of his age was quite enough.

By prohibiting alcohol and cutting down the patients' diet somewhat, the headaches were eventually entirely cured; but I never succeeded in entirely abolishing a peculiar "buzzing sensation in the head" (tinnitus?), of which the patient complained more or less while under my care.

A. N. D., a young woman of twenty, consulted me on account of severe headaches, from which she suffers more or less constantly, and more especially during the menstrual period. She is an excellent illustration of that common class of head-pains which is the direct result of the devitalized and anæmic condition of the patient. For the last four years she has suffered from dysmenorrhœa; her appetite is poor, and she has been a victim of constipation more or less during her whole life. Her heart's action is weak, as reflected in a feeble pulse, which at times is irregular. Her complexion has a tawney, sallow appearance, the conjunctiva is pale and the pupils somewhat dilated.

The indications afforded by the carotids were also

characteristic. When the head was thrown slightly backwards so as to protrude the cervical vertebræ in an anterior direction, these arteries are seen to pulsate slightly ; but on applying the finger they are found to be decidedly more compressible than in healthy or hyperæmic individuals. When both arteries are compressed by the aid of an appropriate instrument, sensations of faintness are at once induced. On suddenly rising from the recumbent posture this feeling of faintness may also be induced, and at the same time the characteristic "clawing" pains of anæmia are at once evoked. There is some sensitiveness to light, but no special hyperæsthesia of the sense of hearing.

The diagnosis in such a case as this is at once apparent: in a word, we have to do with a typical case of anæmic headache ; and the indications for treatment are the counteracting of all those features implied by the word anæmia.

In the first place relief of the cerebral anæmia by alcohol, with consequent immediate stoppage of the headache.

For the purpose of further facilitating the blood-flow to the cerebrum, the patient is to be kept upon her back.

Finally, in order to secure permanent results, the patient's appetite is to be stimulated by bitters, and she is to be put upon a course of systematic over-feeding. Exercise is to be studiously avoided in a case of this kind, at least until there is total disappearance of the head-pains. Towards the end of treatment, massage and general faradization may be resorted to, usually with great benefit.

Nothing of the kind should, however, be attempted at first on account of the danger of diverting the blood-stream from the already impoverished nerve centres.

Under the treatment indicated, the improvement in this case took place with reasonable promptness. At the end of a month there were no pains of consequence ; the patient had already gained several pounds, and I was able to allow her to go about a little. From this time forwards, her improvement was a rapid one, so that at the end of three months, with the exception of the dysmenorrhœa, she was entirely cured and she could take her place in society without discomfort.

C. E. T., middle-aged married lady, has suffered ever since girlhood from "sick-headache."

The pain is exceedingly intense, and is generally located in the forehead. The attacks usually begin in the afternoon, but this is not always the case. Soon after she feels the premonitory symptom of the attack —a "dull feeling in the head"—she is afflicted by intense nausea, which is speedily followed by vomiting.

These symptoms are invariably followed by vertigo, great mental depression and prostration, so that she is obliged to take to her bed, where she remains till the middle of the following day. When she is able to obtain relief, there is practically an end of the matter on the following day ; but where unconsciousness fails to come to the rescue, there is much pain on the following day, and the headache may even persist for three days or more.

Her complexion is sallow, her appetite fair ; but her digestion is habitually impaired, and she has always suffered from constipation.

In her case a pill of podophylline and extr. col. comp. with $\frac{1}{4}$ gr. of hyoscyamus and 1 gr. hydrarg. chlor. mit. never failed to give relief. In addition to this I am in the habit of giving her large doses of bromo-caffein combined with grain doses of the hydrochlorate of cocaine, the latter being administered in

half a tablespoonful of water, ten minutes before giving the bromo-caffein. She declared that she obtained more prompt relief from these measures than from anything she had ever tried. Her tendency to digestive trouble, however, still remained a factor of such obstinacy that, with all I could do for her, I was never able to effect a final abolition of the attacks, which occurred upon the slightest indiscretion of the table, and even as the result of comparatively slight worry, where there was no history of any indiscretion whatever. This is a typical case of that form of megrim of which every practitioner of large experience encounters many cases every year.

In giving these brief histories of the more common forms of intra-cranial pain, I trust that I have not trespassed too much upon the patience of the reader.

It is now in order to consider the second and larger field of our subject, the extra-cranial pains and those co-related phases of neuralgia involving the peripheral nerves at large. It has also seemed appropriate to supplement the discussion by a chapter on that interesting and important affection known as spinal irritation.

PART II.

NEURALGIA.

PAINS WHICH OWE THEIR ORIGIN TO EXTRA-CRANIAL CAUSES.

CHAPTER IX.

GENERAL CONSIDERATIONS.

Under the designation of neuralgia, I propose to consider an affection of the nerves, the chief characteristic of which is severe and sudden pain occurring in one or more nerve trunks and radiating towards the periphery.

Characteristics.—As Dr. Anstie[1] has rightly observed, the first attack is always preceded by a condition of debility resulting from general or special causes. The disease is especially liable to occur in those whose delicate constitutions render them susceptible to sudden changes in the weather or cold draughts of air. This applies with particular force to persons of neurotic temperament, in whom the power of accommodation to violent and rapid changes of temperature is but imperfectly developed.

The onset of the disease is usually heralded by vague muscular twitchings or sensations of pricking, quickly succeeded by evanescent darting pains. The pains are recurrent in character, and succeed each other with ever-increasing frequency and intensity, until, in the more severe attacks, the patient suffers the most excruciating agony.

Sometimes the pains are described as resembling the sensations produced by the prick of red-hot needles; at others the subject complains that he feels as though he were being lacerated with a saw, or as

[1] "Neuralgia and the Diseases that resemble it." London, 1871.

if electric sparks were projected along the course of his nerves. These pains are sometimes stationary and are ascribed by the subject to particular districts, which are found to correspond to the course of a nerve trunk. At other times they are ambulatory and dart from place to place—usually from the centre towards the periphery, but sometimes in an opposite direction. On the application of pressure above the affected nerve, the latter is often found to be extremely hyperæsthetic throughout its entire course, whereas, on the other hand, in a considerable number of cases exploration with the point of the finger reveals the existence of isolated painful spots—"the painful points" of Vallei.

These painful spots are usually located at the points where the nerve-stems emerge from bony canals, or transfix fibrous tissue. They are present in the majority of cases of neuralgia, and careful digital exploration will rarely fail to result in their accurate localization. When exploration with the finger fails to reveal the presence of these *puncta dolorosa*, they may frequently be discovered by resort to the induced current, applied by means of the wire brush. The latter should be gently applied along the course of the suspected nerve, the strength of the current being gradually increased or decreased, to suit the susceptibility of the individual. A small sponge electrode may be substituted for the wire brush; but I prefer the latter, provided that the current can be acccurately regulated. Where the state of the nervous system is one of extreme irritability, the pains are sometimes distributed by irradiation to districts remote from the seat of the primary lesion. It has been asserted by Trousseau that pressure applied to the vertebræ situated at the origin of the painful nerves, causes pain in all neuralgic affections. These sensitive areas along the course

of the cord have been designated by this author as "points apophysaire, or spinous points."[1]

It is evident, however, that there is nothing pathognomic in the phenomena, since they may be present in several affections of the spinal cord; but, nevertheless, they call for special local treatment, of which more will be said in the Appendix on spinal irritation.

Disturbances of sensation are frequently encountered in neuralgia. These may consist in subjective feelings of numbness or formication, or the derangements of sensibility may be more marked, assuming the form of anæsthesia or hyperæsthesia.[2] As a rule, these phenomena are more or less strictly confined to the district throughout which the painful nerve is distributed. Neuralgic affections are sometimes accompanied by certain reflex phenomena, which, as Rosenthal remarks, may be explained by the numerous communications of the posterior root-fibres with the gray substance of the cord. Thus, in neuralgia of the limbs, the latter are subject to spasms which may be local or diffuse in character; while in facial neuralgia sensory irritation gives rise to muscular contractions with more or less distortion of the countenance.

Vaso-motor disturbances are frequently met with in neuralgia. These may consist in circulatory disturbances, properly speaking, or in cutaneous eruptions.

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[1] Trousseau's "Clinical Medicine," Vol. I., London, 1868.

[2] "Beitrag zur Lehre von der Hyperæsthesia und Anæsthesia," von L. Türck, Zeitschrift d. Ger. der Aerzte zu Wien, 1850.

CHAPTER X.

CLASSIFICATION OF NEURALGIA.

(1). TRIGEMINAL NEURALGIA.

In most of the books it is the custom to designate the various nerve-pains according to the nerve-stem or branch chiefly implicated. Thus we speak of trigeminal neuralgia, supra-orbital neuralgia, etc. Following this well-established precedent, we may distinguish the following varieties of neuralgia:

(1). Trigeminal Neuralgia with its sub-varieties.
  (*a*). Supra-orbital (Ophthalmic) Neuralgia.
  (*b*). Supra-maxillary (Infra-orbital) Neuralgia.
  (*c*). Infra-maxillary Neuralgia.
(2). Cervico-Occipital Neuralgia.
(3). Cervico-Brachial Neuralgia.
(4). Crural Neuralgia.
(5). Lumbar Neuralgia.
(6). Lumbo-Abdominal Neuralgia.
(7). Dorso-Intercostal Neuralgia.
(8). Sciatic Neuralgia.
(9). Plantar Neuralgia.
(10). Coccygodynia.
(11). Mastodynia.
(12). Muscular Neuralgia.

In the foregoing classification, I have purposely omitted the visceral pains, as their origin seems still too obscure to admit of final classification. I may add that the forms of nerve-pain above enumerated are of peculiar interest to the physician, inasmuch as they

are amenable to rational treatment of a local character, owing to the accessibility of the nerve-stems involved.

Though the previous general survey of neuralgia affords a fair conception of the main points of interest, as far as the symptomatology is concerned, it will be well to bestow a glance upon the affection as manifested in different localities of the body. Following this plan, I shall adhere strictly to the classification of nerve-pains just given, as it is at once simple and sufficiently comprehensive.

TRIGEMINAL NEURALGIA (NEURALGIA OF THE FIFTH NERVE).

This form of neuralgia is characterized by lightning-like pains, which may extend throughout the entire area supplied by the fifth nerve, or may confine itself to one or more branches of the latter. When the entire nerve is affected, excruciating pain is felt throughout the lateral half of the face and head. Sometimes these pains assume the form of gnawing sensations more or less constant in character, and extending throughout a wide area. At other times the pains resemble those induced by the electric brush, are ambulatory and intermittent, and are referred to by the patient as "flying about" or "shooting through the head."

The painful points are observed at the localities where the nerve emerges from a bony canal or penetrates a fascia. As in other forms of neuralgia the painful sensations do not always confine themselves to the district supplied by the affected nerve, but on the contrary they are projected to regions more or less remote from the primary seat of the affection.

The usual vaso-motor disturbances of neuralgia are observed in this variety of the affection; they consist in pallor and coldness of the skin in the beginning of

the attack, which speedily give place to a red œdematous and glassy appearance of the integument.

In former writings I have referred at some length to the violent pulsations of the carotid arteries, especially of that on the affected side, so frequently present in neuralgia of the face. I would merely observe, in this connection, that if pressure be applied with skill to these arteries, much relief may sometimes be obtained from the distressing pains. The methods devised by myself for executing such pressure have already been described in the previous portion of this work. It must not, however, be imagined that permanent relief can be obtained by such an expedient; for experience abundantly teaches that a cure is alone to be effected by the inauguration of a profound change in the constitution of the nerve filaments themselves. I shall refer to this portion of the subject at length in the chapters on treatment.

It is not surprising that with such profound circulatory disorders, there should also be present in neuralgia derangements of considerable magnitude. These may consist in the first instance in the violent swelling of the face, already referred to, erysipelas, cutaneous eruption, inflammation of the periosteum, iritis, glaucoma, and in quite exceptional cases in neuroparalytic ophthalmia. Where the affection is at all severe. motor derangements assuming the form of spasms of the muscles of the mouth or eyelid of the affected side are frequently present.

Great mental irritability and profound depression are almost invariably present where the affection is severe and has lasted for some time. As a result of this protracted strain, it is not surprising that the subject may ultimately be completely prostrated or even driven to suicide, or the mad-house.

CHAPTER XI.

TRIGEMINAL NEURALGIA, CONTINUED.

MODIFICATION IN THE SYMPTOMS OF FACIAL NEURALGIA CONSEQUENT UPON THE RESTRICTION OF THE PAIN TO ONE OR MORE BRANCHES OF THE NERVE.—CERVICO-OCCIPITAL NEURALGIA, CERVICO-BRACHIAL NEURALGIA.

As already observed, the pain may extend throughout the entire territory supplied by the fifth nerve, or may confine itself to one or more branches of the same. One of the most frequent of these sub-varieties of facial neuralgia is :

(a). *Supra-orbital or Ophthalmic Neuralgia.*—In this variety of the affection the pain is located in the forehead, particularly in the district immediately above the affected nerve. The upper eyelid is also usually painful. As in the other forms of facial neuralgia, there is lachrymation, and congestion of the conjunctiva. Just at the point where the nerve emerges through the supra-orbital foramen there is a painful point of great constancy. This variety of facial neuralgia is usually traceable to malarial influences. The knowledge of this fact leads many physicians to prescribe large doses of quinine where this branch of the nerve is affected ; and when they have done this, they assume, apparently, that their duty to their client has been fulfilled. This seems to me poor practice, to say the least. My own mode of dealing with such cases

is to first abolish the pain, by the method of local medication, which I shall presently describe, and then proceed to general measures.

(b). *Supra-maxillary Neuralgia.*—In those cases where all the branches of the second division of the fifth nerve are involved, the pain is located in the eyelid, cheek, nose, upper lip, nasal cavities and gums, upper teeth, and in the zygomatic arch and temporal region. Sometimes, however, the infra-orbital branch of the second division of the nerve is alone affected (infra-orbital neuralgia). Under these circumstances the pain is felt in the upper lip, cheek, teeth of the upper jaw and zygomatic arch.

The painful points of supra-maxillary neuralgia are located where the nerve leaves the skull; on the molar bone, on the upper lip, and in rare instances on the palate.

(c). *Infra-maxillary Neuralgia.*—It is necessary in considering this variety of neuralgia to differentiate sharply between a complete or only partial implication of the third division of the fifth nerve. When the entire third division is involved, there is pain in the lower teeth and lower jaw, in the mucous membrane of the mouth, in the tongue, in the chin, in the temple and cheek, and in the external auditory meatus and auricle of the ear.

The more important painful points are: the inferior dental, situated opposite the point of exit of the nerve; the temporal, located a short distance in front of the ear; the parietal point, near the parietal eminence; the lingual, on the side of the tongue; and the inferior labial. When only a portion of the nerve is affected, the pains will of course be more or less confined to the region supplied by the branch of the nerve most seriously implicated.

When, in facial neuralgia, the pains appear in rapid succession, as a distinct seizure, lasting a few seconds and then disappearing, but only to recur after a shorter or longer interval, we speak of the condition as epileptiform neuralgia. This is one of the most atrocious varieties of pain known to medicine, and is usually developed in those of well-marked neurotic tendencies.

(2.) CERVICO-OCCIPITAL NEURALGIA.

As a rule, the pain is confined to the region supplied by the great occipital nerve. The patient complains of pains in the occipital and posterior parietal regions, which, in exceptional cases, are reflected to the neck, brow, cheek, temple or inferior portion of the face, and which may therefore give rise to the supposition that we have to do with a true case of facial neuralgia. A careful search for the painful points will, however, usually serve to aid in the formation of a correct diagnosis. The sensitive points are usually located where the nerve approaches most nearly the surface, but their situation is subject to some variation.

(3.) CERVICO-BRACHIAL NEURALGIA.

The pain in cervico-brachial neuralgia is perceived in the sub-clavicular region, throughout the course of the upper extremity, and sometimes in the breast. When we consider that the five lower cervical and first dorsal (brachial plexus) may be wholly or partially involved, this wide distribution of the pains is easily understood.

When the plexus is only partially affected, it is difficult to determine what branches of the plexus or nerve-roots are especially involved, owing to the manner in which the nerves are interlaced.

The painful points are quite variable; we present a few of them:—A radial point at the lower external aspect of the fore-arm; an ulnar point between the olecranon and epitrochlea; a median cephalic point, at the elbow; a shoulder point, where the cutaneous branches of the circumflex pierce the deltoid; an axillary point, corresponding to the brachial plexus.

Rheumatism and injuries are the chief causes of this variety of neuralgia, just as malaria is the chief source of certain phases of facial neuralgia.

I have been thus explicit in treating of the neuralgias of the head, face, neck and fore-arm, because a proper understanding of their various phases is often of great value in forming a correct diagnosis, particularly when it is necessary to differentiate between pains of intra-cranial and those of the extra-cranial origin. As to the remaining varieties of neuralgias, I shall make short work of them, as they are of subordinate importance in a treatise of this character.

CHAPTER XII.

OTHER VARIETIES OF NEURALGIA.

(4.) CRURAL NEURALGIA.

In this variety of neuralgia. the pain is felt along the central and inner portion of the anterior aspect of the thigh. The pain, following the ramifications of the nerve, may also extend to the lower portion of the limb.

As this variety of neuralgia is not very common, little need be said of it, except that the painful points usually met with are situated near the groin, at the inner side of the patella and in the vicinity of the ankle joint.

(5.) LUMBAR NEURALGIA.

The pain is located in the loins, and may involve any or all of the first four pairs of lumbar nerves.

(6.) LUMBO-ABDOMINAL NEURALGIA.

Besides the loins, the mons veneris, the scrotum, and notably the hypogastrium are the seat of pain. In the more extreme cases, the gastric and sexual functions may exhibit more or less derangement, manifested by vomiting and involuntary ejaculations of seminal fluid.

The most constant painful points are those located over the posterior branches of the affected nerves.

Other points are given in the books, but they are far from constant.

(7.) DORSO-INTERCOSTAL NEURALGIA.

In this form of the affection, the pain is located in the back and in the anterior and lateral walls of the thorax. When the pain in the back is the prominent symptom, the condition is popularly known as lumbago, and it is assumed that the pains are due to rheumatic or muscular causes.

In severe cases all attempts to bend forward or backward are accompanied by great pain; while, where the intercostal pain is a prominent feature, respiration is likewise difficult and painful. The most constant painful points are found over the points of emergence of the sensory nerves from the intercostal foramina. Where the nerves are most superficially located, painful points may likewise be found in most cases.

Neurotic and anæmic persons are particularly prone to become the victims of this variety of neuralgia. Thin-blooded women, especially between the ages of twenty-five and fifty, are subject to it.

The most prolific exciting cause is exposure to cold and damp.

As a matter of course, pains of this character may be induced by neoplasms, and inflammatory and degenerative changes involving the vertebræ.

(8.) SCIATIC NEURALGIA.

In this variety of neuralgia, the pain follows the area of distribution of the sensory filaments of the great and small sciatic nerves. The subject complains of intense burning, boring, cutting or shooting pains, extending from the gluteal region down the posterior

aspect of the thigh and ankle to the sole of the foot. In exceptional cases the pain may be confined to the gluteal region.

The principal painful points are located where the nerves emerge from the pelvis; at the points where the cutaneous nerves pierce the fascia; at a spot located near the head of the fibula; an external and an internal malleolar point.

A debilitated condition of the system from fevers or other constitutional causes, constitutes the most important predisposing factor. Among the exciting causes may be mentioned exposure to cold or dampness, and various pathological conditions of the pelvis, giving rise to pressure upon the sacral plexus. This affection is more common among men than among women, though I have witnessed several cases occurring among the latter, as the result of debility or some form of uterine displacement. In the chapter devoted to the treatment of neuralgia, I shall have something to say concerning the special measures to be adopted in the local treatment of sciatica.

(9.) PLANTAR NEURALGIA.

This form of neuralgia is characterized by intense pain beginning in the heel or great toe, and extending throughout the sole of the foot. As a rule, both feet are affected. Associated with the pain, there is extreme vascular distension and redness of the affected area. Walking increases the pain, while after the subject has remained in the recumbent posture for some time, the symptoms are greatly alleviated.

Dr. S. Weir Mitchell was the first to give a full and accurate description of this affection.

Probably the congestion of the affected area, coupled

with more or less neuritis of the plantar nerves, is the true cause of the affection.

The affection should be treated by bathing the feet in solutions of carbolic acid of sufficient strength to cause exfoliation of the plantar epidermis on scraping with an ivory paper knife. Subsequently the plantar nerves should be medicated locally according to the method which I shall presently indicate in the chapter on treatment. While the patient is at rest, the extremities should be kept somewhat elevated. This is best accomplished by elevating slightly the foot of the bed by means of blocks of wood of a thickness of from two to three inches. At first difficulty in sleeping will be experienced by the patient, but this is soon overcome, especially if a relatively high pillow be employed.

(10.) COCCYGODYNIA.

This term has been applied by Scanzoni, Erichsen, Simpson and others, to neuralgia of the ramifications of the coccygeal plexus.

The affection manifests itself chiefly by severe pain in the coccyx, which is greatly aggravated by sitting or straining at stool. Persons afflicted by coccygodynia sit upon a soft cushion, or in the absence of the latter upon the edge of the chair.

The affection is particularly prone to occur in women as the consequence of difficult or complicated labor, or as the result of some uterine derangement. Injuries, inflammation of the coccyx or its ligamentous attachments, caries and ankylosis may also cause it.

The treatment of this form of pain by leeching, fomentations, baths, electricity and the like, is at most merely palliative. In the severer cases, relief must be sought by resort to surgery.

An American surgeon, of Alabama, extirpated the coccyx in 1832 ;[1] and since that time the procedure has been frequently resorted to. and with reason, as the chances of abolishing the pain by this means are much greater than when section of the ligaments and muscles is performed, as recommended by Simpson.

(11.) MASTODYNIA ("IRRITABLE BREAST").

This is merely a variety of intercostal neuralgia. The predisposing causes are the same as those of other forms of neuralgia. Among the exciting causes may be mentioned injuries of the gland, cracked or shrunken nipples, and tumors which press upon the nerves.

The painful points are exceedingly variable, and are therefore of little practical moment. Spinal tenderness, especially in the region of the upper dorsal vertebræ is, however, fairly constant.

Where the cause is manifest, it should be removed as speedily as possible ; and meanwhile the patient should be relieved by the administration of opiates.

(12.) MUSCULAR NEURALGIA.

Both physician and patient have long been in the habit of referring certain painful sensations to the muscles. The muscles most frequently involved are those of the back and neck ; and inasmuch as these muscle-pains frequently exist quite independent of any exaggeration of cutaneous sensibility, the popular mode of regarding them as due to an abnormal condition of muscular sensibility seems justified.

The same methods of treatment to which resort is

[1] "American Journal of the Medical Sciences," III., 1833.

had in cutaneous neuralgia, may, with slight modifications, be employed in combating these hyperæsthetic conditions of the muscles.

These, then, are the varieties of neuralgia most frequently encountered in practice.

In the succeeding chapters, I shall enter into a consideration of the causation, diagnosis, pathology and prognosis of neuralgia, as a preliminary to the discussion of the various factors involved in treatment. This latter portion of the subject is evidently of the first importance ; and I shall therefore offer no apology for devoting much space to its elucidation.

CHAPTER XIII.

CAUSATION.

THERE is no doubt that hereditary influences occupy a conspicuous place among predisposing causes. As previously observed, those who have received from their progenitors sickly constitutions or pronounced neurotic tendencies frequently become the victims of periodic neuralgias. This liability to transmission, which is a pronounced characteristic of nervous disorders in general, is particularly well exemplified in the various forms of mental derangement.

It is a well-known fact that in those diseases the hereditary taint often affects the mental integrity of many generations; comparatively trivial causes being required to evoke active mental alienation in individuals who have inherited the insane diathesis. A similar state of things is often observed in connection with neuralgia. Fathers and mothers afflicted with neuralgia frequently transmit a predisposition to this or some other form of nervous derangement to their offspring, and the latter in their turn bequeath the morbid tendency to future generations.

The most severe varieties of the affection are observed among those in whom the vital forces have been greatly curtailed through the agency of wasting diseases or general malnutrition. Anstie[1] has assumed a hereditary weakness of the ganglia of the posterior columns, which, when subjected to protracted centri-

[1] "Neuralgia and Diseases that Resemble It." London, 1871.

petal irritation becomes the seat of interstitial atrophy. For my own part, I cannot accept this hypothesis, since if in all cases of neuralgia such a serious lesion were present, it would be difficult to conceive of cures taking place at all.

As is well known, not a few cases of the affection yield to hyper-nutrition and local treatment, a fact difficult of explanation, if a positive destruction of nerve cells be conceded to be an invariable concomitant of the affection. Climatic peculiarities exercise a marked influence upon the evolution of neuralgias. The most favorable season for the development of the affection is during the cold, damp months of the year. Sudden changes in temperature, as already noted, are particularly prone to develop an invasion of the disease. Exposure to cold and violent winds, as well as residence in damp, dark, and badly ventilated dwellings, is liable to cause an attack of neuralgia, which has a marked tendency to become chronic, unless a change of climate be immediately sought.

Previous to marriage, females are, on the whole, more liable to the affection than men.

The neuralgias which frequently follow chronic pulmonary affections, chlorosis, and other debilitating maladies, are the result of inability on the part of the vitiated blood to adequately nourish the peripheral and central nervous system.

The characteristic lancinating pains of neuralgia are often observed in conjunction with disturbances of the central as well as peripheral nervous system. It has been affirmed that certain congestive cerebral conditions may give rise to neuralgia, and the association of the disorder with tumors, softening or sclerosis is not uncommon. A number of inflammatory affections of the cord are accompanied at the outset by

neuralgic symptoms; the lancinating pains of ataxia are a good illustration of this. It is probable that the dyscrasic and toxic forms of neuralgia owe their existence to the effects of the deleterious substances upon the nerve cells of the posterior columns. At all events this seems a more plausible supposition than the pathological hypothesis of Anstie, already referred to.

The peripheral causes are those which most concern us here, since they constitute the etiological factor most frequently encountered among cases commonly designated as neuralgia. In this category belong: (1.) causes which, acting upon the periphery of the nerve, cause compression of the latter. Thus caries and periostitis involving the foramina of bones, through which the nerves pass, may cause a sufficient degree of constriction to set up inflammation of the neurilemma. (2.) Rheumatic influences, affecting the nerve fibres of muscles and joints. (3.) Foreign bodies and growths, such as syphilitic gummata, tumors and aneurisms. (4.) Congestive and inflammatory conditions of nerve-sheaths. (5.) Finally there are certain neuralgias which owe their origin to irradiation and reflex causes.

CHAPTER XIV.

DIAGNOSIS.

The proper differentiation of the central from the peripheral varieties of the affection is evidently a matter of consequence from a prognostic point of view. To summarize briefly the requisites of such discrimination, it may be stated, in the first place, that where central causes are suspected a careful analysis of the condition of the brain and spinal cord should be undertaken, both by means of objective observation and interrogatories addressed to the patient himself. If we thus, for example, diagnosticate with reasonable certainty hyperæmia, inflammation or softening of the brain or spinal cord associated with "neuralgiform" pains, and if, at the same time, we are unable to discover any defect of the peripheral nervous apparatus, we are justified in concluding that the central disorder is the true cause of the pains, which, in accordance with the laws of eccentric projection, are referred to the periphery.

When frontal headache, reflex contractions of the face, with lacerating pains along the course of certain nerves and hyperæsthesia, are associated with well-marked psychical disturbances, the suspicion that the neuralgia is of cerebral origin is justified. When facial neuralgia co-exists with ambulatory-pains in the limbs and neck, associated with vertigo, periodic headache, convulsions, evidence of neuroretenitis, and paresis of various cranial nerves and eventual paraly-

sis of the extremities, we have presented unmistakeable evidence of cerebral tumor.

The symptoms which point to the spinal origin of neuralgia are : early formication in the toes and fingers, numbness, sensations of cold, periodic rachialgia and brachialgia, lancinating pains along the course of the sciatic nerve with cutaneous hyperæsthesia, inequality of the pupils, diplopia, irritation of the sexual organs, fatigue on slight exertion, extreme excitability to the electric current in certain circumscribed localities, and susceptibility to moisture and variations of temperature.

CHAPTER XV.

PATHOLOGY.

The older pathologists were in the habit of describing "scorbutic," "rheumatic," "scrofulous," and "arthritic" forms of neuralgia. Among more recent writers, however, it has become fashionable to attribute the pain experienced in these and certain constitutional affections to secondary causes, such as disease of the blood-vessels, congestion or inflammation propagated to neighboring blood-vessels,[1] etc.

The hysterical variety of neuralgia is usually characterized by the ambulatory nature and variable intensity of the pains, which usually follow upon hysterical convulsions or violent mental excitement.

The agency of syphilis in the production of the affection has long been recognized. In all probability the dyscrasia is capable of causing the characteristic neuralgic pains by the inauguration of changes in the central or peripheral nervous system or both. Thus chronic inflammatory processes located in the blood-vessels and connective tissue may affect the cord and peripheral nerves as well, thus giving rise to neuralgiform pains. Or, osteal and periosteal diseases may affect the peripheral nerves in their transit through bony foramina, producing constriction or inflammation, and thus causing violent pains.

In a comparatively recent publication, Fournier[2]

[1] See Article by Erb, Ziemssen's Cyclopedia, Vol. XI.

[2] Leçons sur la Syphilis, 1873.

has drawn attention to the typical varieties of neuralgia which occur in women during the secondary period of syphilis, and which evince a marked predilection for the supra-orbital and sciatic nerves. The mucous membranes of the stomach, rectum, urethra and intestine are frequently the seat of neuralgiform pains; when thus situated the latter usually point to an hysteria or central affection.

There are a number of toxic substances which, when introduced into the system, may give rise to more or less severe neuralgic affections. In this category belong lead, copper, and mercury. Persons who have contracted syphilis, and who have subsequently become thoroughly mercurialized, frequently develop an obstinate form of neuralgia. Alcohol and tobacco when employed to excess may also give rise to neuralgiform symptoms; but the precise manner in which these toxic agents act is still, to a considerable extent, enveloped in obscurity.

The influence exercised by lead in the production of neuralgic affections has long been understood, and hence the designation lead arthralgia, lead colic, etc.

CHAPTER XVI.

PROGNOSIS.

The first step of importance in predicting with reasonable probability the prospect of cure in neuralgia, is an accurate determination of the exciting cause. Where the latter consists in an organic affection of the brain or spinal cord the prognosis is unfavorable, in the majority of cases; and the most that can be obtained is a temporary alleviation of the symptoms. The same may be said of those cases which are attributable to permanent organic changes of structures contiguous to nerve stems. Thus the neuralgic affections resulting from osteal and periosteal diseases, tumors and remote and inaccessible cicatrices are practically incurable. On the other hand, those varieties of the affections which result from malaria and syphilis are exceedingly amenable to treatment, and the prospect of ultimate recovery in such cases is good.

As a rule, then, peripheral neuralgias offer a far better prognosis than those which result from organic affections of the central nervous system. When the source of peripheral irritation has been removed recovery usually ensues; but it is hardly necessary to draw attention to the well-known liability to relapse which asserts itself when the patient is unduly exposed to sudden variations of temperature. The prospects of recovery are more favorable in men than in women. Moreover, the question of age is of no little importance in determining the prospects of recovery; and it may

be stated in general terms that the prognosis is decidedly better among the young than in those of advanced life.

The occurrence of atrophic changes, anæsthesia or paralysis in the course of the affection may be regarded as a sign of ill-omen as far as the chances of ultimate recovery are concerned

Where the *puncta dolorosa* persist, after the pain has subsided, the prospect of a relapse is greatly increased. In the majority of cases the immediate danger to life may be regarded as *nil*. Sometimes, however, where the general constitution is feeble, and where the symptoms have persisted for a long time, the strength of the subject finally gives way, and death ensues from marasmus or some intercurrent affection.

Neuralgia in its most severe form has frequently been the cause of suicide ; a case of this kind recently occurred in New York City. Even where the condition of the patient is not so desperate these atrocious face-pains necessarily seriously jeopardize the success and happiness of their unfortunate victim ; and, as already intimated, they sometimes cause permanent mental trouble.

CHAPTER XVII.

TREATMENT IN GENERAL.

As a matter of course, it is of importance to ascertain the exciting cause in each case, and, by the removal of the same, insure a permanent cessation of the neuralgic symptoms. Unfortunately, however, the discovery of the predisposing cause was in former times a much easier matter of attainment than the subsequent removal of the pain when it had once become firmly established; this at least was the case previous to the discovery of the analgesic properties of antipyren and cocaine, and the methods of prolonging the action of the latter drug. As I have devoted considerable time and study to the development of the capabilities of the last mentioned remedy in the treatment of painful nervous affections, and as, moreover, the methods which I have devised enable the physician to accomplish much with exceedingly small doses of the drug, I shall presently describe at length the various features involved in this mode of local treatment. Let me state, however, before proceeding further, that I always arrest the local pain as far as possible, by resort to those methods of local medication, before seeking to remove the more remote constitutional causes.

Thus while our resources must, to a considerable degree, be directed towards the local symptoms, we should not fail, at the same time, to combat the obvious predisposing factors as far as possible, especially when

the latter are of a more or less constitutional character, and consequently proportionately amenable to treatment. Thus, in consonance with these views, if the subject, in conjunction with neuralgia is likewise a sufferer from general anæmia, a causal relation between the two diseases may be assumed to exist, and accordingly energetic constitutional treatment should be employed in conjunction with proper local medication. When scrofulosis, gout, tuberculosis and syphilis are found associated with neuralgia, appropriate medicinal and dietetic measures should be directed against the dyscrasic condition, and reliance should, under no circumstances, be entirely placed upon local symptomatic treatment. Where the neuralgia occurs periodically and its appearance is demonstrably associated with malarial influences, quinine should be given in large doses.

As I have said, however, we should relieve the local pain before resorting to this or any other mode of constitutional treatment. Sometimes a few doses of quinine are beneficial, but I cannot agree with a well-known writer, that such brief medication is sufficient to cause permanent disappearance of the pain-provoking condition. In the majority of cases it is well to continue the use of the drug for several days or weeks.

Even when the malarial condition has apparently yielded to treatment, and the pains have ceased to recur, a short sojourn in a malarious district is quite sufficient to cause a relapse. If, by careful scrutiny of the history of the case, it be possible to discover a toxic influence, such as that induced by the introduction of lead, mercury or alcohol into the system, appropriate means should be employed for removing the foreign substance from the economy.

Among the less-complicated causes of neuralgia are

wounds, cicatrices, the presence of foreign bodies of various kinds and the mechanical effects produced by the compression of nerve-stems by impacted fecal masses, periostitis, tumors and cicatricial tissue deposited as a result of previous inflammatory or traumatic causes. In those cases which are directly attributable to rheumatic causes, good results are obtainable from the employment of the Turkish or vapor baths; but, as a rule, not much is to be gained by the local application of blisters and sinapisms. The iodide of potassium may also be given, and the resort, during the winter months, to a mild and equable climate, will often prove of considerable benefit. When neuritis can be clearly diagnosticated as the exciting cause of the affection, derivation by means of the bowels and skin should be employed, and resort may also be had to local applications of cold and dry or wet cups.

Better than all these, however, in well-marked neuritis, is the local medication of the nerve-filaments, already referred to, and which I shall presently describe at length.

In the cases which owe their existence to a primary organic affection of the brain or spinal cord, but little of permanent good can be anticipated from treatment. As already intimated, treatment in such cases must of necessity be addressed more or less directly to the symptoms themselves, and above all to the problem of attaining, from time to time at least, a temporary abatement in the intensity of the pains. Electricity, hydrotherapy and the various opiates, particularly antipyren—or, if absolutely necessary, morphia—are our best aids under the circumstances.

Among the various remedies which have been employed, with a view to combatting pain in all its forms, and particularly severe intra or extra-cranial pain,

not one is more deserving of our confidence than antipyren. At the meeting of the *Académie de Médicine* at Paris on the 23d of August, 1887, M. Germain Sée drew attention to the valuable analgesic quality of this drug, especially in headache, migraine and faceache. The cases which he presented on this occasion showed in a striking manner the potency of this remarkable drug to relieve suffering.[1]

Subsequently this gifted clinician showed[2] how powerful are the analgesic effects of this remedy in acute and chronic articular rheumatism.

This is not the place to enter into a protracted discussion of the physiological effects of the remedy. Enough, that we have seen M. Sée's statements confirmed again and again, so that at the present time it would be difficult to find a practitioner who has not had occasion to endorse to a great extent that which has been affirmed for this admirable remedy as an antidote to pain in many of its phases.

For my own part, I would merely state that I have used antipyren not only in all forms of intra and extra-cranial pain, but in spinal irritation and spinal concussion as well, with excellent results, and more particularly when given in conjunction with local expedients, such as injections, refrigeration and the like. I have also witnessed most striking results from its use when combined with relatively minute doses of morphine.

This experience with the remedy has confirmed the belief that in antipyren we have one of the most valuable, and at the same time safe, drugs ever introduced

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[1] *L'Union Medicale, Troisième Serie*, Vol. XLIV., page 273, *et seq.*, 1887.

[2] *L'Union Medicale, Troisième, Serie*, Vol. XLIV., p. 349, 1887.

to the profession. I shall have occasion to refer to this useful drug hereafter.

Having said this much in a general way regarding the points to be kept in view in any rational system of therapeutics, it now remains to describe the methods by which it is possible to submit the painful nerve and its branches to the action of various potent remedies, such as cocaine, pyrogallic acid, aconite, etc.

From my own experience, as well as from that of other physicians who have occupied themselves with the subject, I cannot help feeling that this mode of treatment constitutes one of the most powerful means at our disposal for directly combatting these neuralgias of the face, whatever their remote origin may be.

To the end that the various details involved in this mode of neural medication may be the better understood, I shall preface the description of the individual steps of the procedure by a few considerations of a somewhat general character.

CHAPTER XVIII.

LOCAL MEDICATION OF NERVES.

OF REMEDIES WHICH ARE ADAPTED TO THE MEDICATION OF NERVES.

It is not my intention on the present occasion to enter into an extended discussion of the intricate pharmaco-dynamical questions involved in the treatment of affections of the peripheral nerves.

To do this would presuppose an intimate knowledge of the chemical constitution of nerve tissue; and such knowledge is, in the present state of medical science, denied us. While we cannot, therefore, know what chemical reactions are produced by the contact of a given medicament with the substance of a nerve, we can at least take cognizance of any considerable modification in the function of the latter thereby induced.

Adopting this mode of regarding the question, we find that, with the remedies and methods at our disposal, we are able to accomplish three things. We may temporarily suspend the conduction in a nerve; or we may change its constitution to such a degree as to more or less permanently interfere with the transmission of impression through the same, or finally we may destroy the nerve filaments altogether. The first problem is best accomplished by the use of cocaine; the second by the application of chloroform or ether, immediately after the cocainization of the nerve, or

by mechanical aids for a certain length of time, and the last by the use of acids or the knife.

The first mode of procedure is that which I prefer in cases of moderately acute nerve-pain, reserving the second method for exceptionally obstinate and chronic cases. As to the last method, it should not be resorted to except in exceptional cases.

It will therefore be my object on the present occasion to show first how remedies may be best introduced into the immediate vicinity of painful nerves, and how their benignant action upon the latter may be perpetuated.

METHOD OF INTRODUCING COCAINE INTO THE SKIN ABOUT THE FACE.

First of all it is necessary to ascertain what branch or branches of the fifth nerve are affected. To this end the patient should be carefully interrogated as to where the painful sensations are located, and afterward a careful digital exploration undertaken by the physician, with a view to discovering any painful points in the continuity of the nerve-stems which may serve as a guide to a more accurate diagnosis.

Having thus determined what are the offending branches of the nerve, it only remains to introduce the medicament into the painful territory. This may be accomplished with great ease and accuracy about the face, on account of the superficial location of the sensory nerves. Moreover, by the aid of the method which I am about to indicate, it may be achieved absolutely without pain or inconvenience to the patient.

The procedure, then, which I have found effective for the purpose is as follows:[1]—The region to be

[1] "New York Medical Journal," Vol. XLIV., Nov. 19, 1886. See

anæsthetized is first perforated by means of a delicate instrument provided with a large number of fine needles. There is no pain in the simple manipulation, as the needles, being released, are driven into the skin so quickly that there is no sensation whatever. Again, it is necessary to allow the needles to penetrate beyond the epidermis.

Having thus increased the porosity of the skin so as to admit of the passage of the medicament into its deeper layers, it only remains to introduce the same as speedily as possible. This is best accomplished by the aid of the galvanic current. A sponge electrode, saturated with a solution of cocaine of appropriate strength (5%), is secured by means of an elastic band over the perforated territory. This electrode is then attached by means of a reophore to the positive pole of a galvanic battery. A similar electrode saturated with warm water is secured as near as possible to the first sponge, *but without touching it*, and is then connected with the negative pole of the battery by an appropriate conducting cord. It now only remains to so regulate the switch board that from four to six cells are brought into operation. As for myself, I usually begin with three cells, gradually increasing the strength of the current until five or six cells are brought into requisition. By adopting this policy there is no inconvenience from the action of the current, unless a slight acid taste can be described as such.

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also Webster, David, M. D., on Corning's method, "Medical Record," March 5th, 1887.

Benjamin Richardson, of London, was the first, so far as I know, to induce local anæsthesia by the use of a chemical in conjunction with a galvanic current. Subsequently Wagner employed the same method in conjunction with cocaine. I improved Richardson's procedure by introducing the principle of preliminary painless puncture of the skin.

It is quite impossible to lay down infallible rules as to the length of time which it is expedient to allow the current to operate, since much must depend upon the strength of the battery and the extent of the territory which it is desired to medicate. At all events ten, or at most twenty minutes will usually be sufficient; and should the pain not yet have subsided, a supplementary injection of a three-per-cent solution of the remedy may be resorted to. As a rule, however, the pain will be found to have left the part after the current has operated for eight or ten minutes.

The prolongation of the action of the medicament is of great importance in the treatment of neuralgia, as we are thereby enabled to expose the affected nerve filament for a long time to the influence of the remedy. That the chemical action of the latter upon the painful nerve filaments is thereby immeasurably increased, is beyond question. This prolongation of the effects of the remedy may be accomplished in a twofold manner, to wit: (1.) By the employment of certain mechanical appliances, and (2.) by resort to certain potent chemical agents, (chloroform, acids, ether, etc., etc.) I shall describe at once the first (mechanical) mode of procedure, as it is at once simple and efficacious.

CHAPTER XIX.

LOCAL MEDICATION OF NERVES, CONTINUED.

THE PROLONGATION OF THE LOCAL ACTION OF THE REMEDY.—AUTHOR'S METHOD.

When cocaine is employed about the extremities it is an easy matter to perpetuate its action to any reasonable extent. We have only, in fact, to suspend the action of the *arterial* and *venous* circulation, as I have long since shown [1] by the aid of an appropriate bandage. By this simple means we are enabled to keep the anæsthetic for any reasonable time in contact with the nerve filaments: for, the circulation in the part being suspended, the blood cannot wash away the anæsthetic into the general circulation. Likewise, about the breast and back, we can accomplish, though in a much more imperfect manner, a similar condition of affairs by resorting to compression by the aid of rings, clamps and the like. When, however, we desire to perpetuate the action of the drug about the face the problem is wholly different, since these mechanical devices are not available. To meet this difficulty I have devised the following mode of procedure: [2]

[1] See also Wyeth, John A., on Corning's method of inducing cocaine anæthesia ("A Text-book on Surgery," New York, 1887, p. 22.) Also Smith, Stephen, on Corning's method, "Principles and Practice of Surgery," Philadelphia, 1887, p. 54 *et seq.* See other communications on the same subject by J. R. Conway, J. Williston Wright, Robert F. Weir, M. J. Roberts, and others.

[2] "The Medication of Nerves, and its Application in Treatment

Having introduced the anæsthetic throughout the painful territory, according to the method previously described, I place over the part a piece of fine wire gauze (Fig. V.), which is trimmed with a pair of scissors so as to exactly cover the medicated zone. A T-shaped block of wood is then placed upon the wire gauze, and a considerable degree of pressure applied, by means of an elastic strap which encircles the head and is secured in place by means of a buckle (Fig. VI.). As a result of this procedure the wire gauze is pressed well into the skin, and the septa of the same cause occlusion of the subjacent capillaries, but without pressing out the cocaine, which remains caught, as it were, in the meshes of the wire gauze. By this method I have often produced a state of complete anæsthesia lasting an hour and a half. It is not surprising, therefore, that such a protracted exposure of the nerve filaments to the chemical influence of the drug should often of itself result in a permanent abolition of the painful sensations. Where the pain is located above the eyes, as in supra-orbital neuralgia or in the temple, this mode of treatment acts like magic.

A slight modification in the mode of procedure is necessary, especially in emaciated subjects, when the pain is more diffuse, extending to the cheeks and lower portion of the face. Under these circumstances, I am in the habit of first tamponing the cheek, which is readily accomplished by packing the face between the alveolar processes and the cheek with small pledgets of cotton. The cheek being thus distended, it is easy to press the wire gauze upon the skin with sufficient force to cause occlusion of the subjacent capillaries.

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of Neuralgia and other Painful Affections." A paper read before the Medical Society of the State of New York, Feb. 1st, 1887. Published in the "Medical Record" for March 19th, 1887.

I can truly say that this plan of treatment has yielded better results in my hands than I have been able to obtain by the aid of that polypharmacy which has been so fashionable during the last thirty years.

Sometimes, in uncomplicated cases, one application

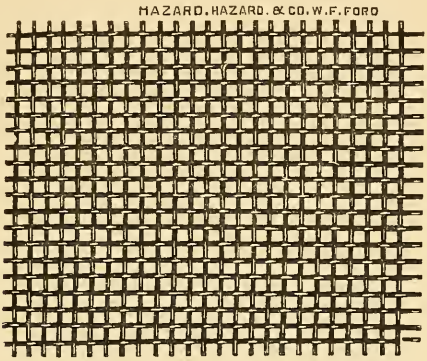

Fig. 5.—Showing the kind of Wire Gauze to be Employed.

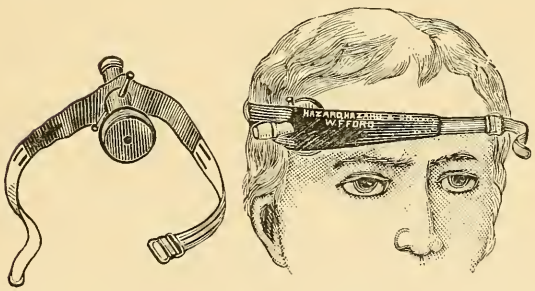

Fig. 6.—Showing Application of Gauze Block and Elastic Strap, for Relief of Pain in Temporal Region.

is sufficient to abolish the pain for weeks or even months. In others, again, the pain may return after a few days, but with less intensity. All that is then necessary is to repeat the procedure, as the punctures are so small as to leave no scars behind, hyperæmic

spots about these minute openings disappearing within a few days, as already observed. Constitutional treatment should usually be continued side by side with these local measures, so that the nutritive conditions of the organism at large being improved the affected nerve-stems may also take part in the general amelioration.

I will merely add that having produced an anæsthetic zone of the desired extent, such remedies as chloroform, ether, aconite and pyrogallic acid may be injected without the slightest pain or inconvenience. The effects of these remedies upon the nerve-filaments may then be prolonged to any extent by the application of the gauze, block and strap.

So much then for prolonged local medication of the nerves — a method which has already accomplished and will undoubtedly continue to accomplish much in a department of neurology where unfortunately but little of practical moment has heretofore been achieved.

CASES.

Although an extended recapitulation of the details of the clinic would be a work of evident supererogation in a monograph of this character, I may perhaps claim the indulgence of my professional readers if I take the liberty of citing a few illustrations of the more important phases of neuralgic pain.

Let us begin, then, by giving the principal points in some cases of sciatica which I have treated principally by the aid of local measures.

Before proceeding to details, however, I would again call to mind the fact that three years ago I brought to the notice of the profession[1] certain re-

[1] "New York Medical Journal," Sept. 19th, 1885.

searches through the instrumentality of which I ascertained a variety of facts of both medical and surgical importance. In the first place, I conclusively demonstrated that the suspension of the *arterial and venous* circulation in a part into which such an anæsthetic as cocaine has been injected is sufficient to prolong the anæsthetic effect for any length of time.

Secondly, I showed that when the precaution of suspending the circulation has been observed, it is no longer necessary to employ strong solutions of the anæsthetic; but, on the contrary, the strength of the latter may be reduced to an incredible extent, and yet anæsthesia of the part be induced and definitely protracted. The significance of these facts was at once appreciated by a large number of surgeons; and soon medical literature in both this country and Europe began to teem with the accounts of numerous operations, more or less extensive, in which my method of inducing local anæsthesia had been resorted to with excellent results. After these reports of successful operations had continued to appear for several months, giving rise to continuous comments both in this country and Europe, I decided to select some of the more noteworthy of these cases, and to embody the same in book form. At the same time I availed myself of the opportunity afforded by this publication to elaborate the technique of my method, so as to make it almost universally available. ("Local Anæsthesia," by J. Leonard Corning, M. D., New York: D. Appleton & Co. 1886). The reception by the medical press and the subsequent large sale of this book have convinced me that my endeavors in the cause of scientific medicine have been amply appreciated by my colleagues in the profession. All this is, of course, gratifying. Still, while I was glad to have rendered

service to such of my colleagues as are engaged in the practice of surgery, it was but natural that the desire should have been rife, in one interested in neurological medicine, to make the method of some use in that branch of practice. Indeed, I will admit at once, that, at the very beginning of these labors, I saw certain possibilities in this direction, particularly in the treatment of derangements of the peripheral nerves. Thus, in my original paper, I said: "In the treatment of neuralgias, and other disorders of the peripheral nervous system, it (my method) is, I believe, destined to render good service." For some time these scientific anticipations remained without fruit of a practical nature; for, indeed, my professional engagements had been such that I was unable to follow them to a practical sequence. Some time since, however, I was able to put these ideas to a practical clinical test, and it is with a view to reporting the results more fully that I have indulged in these reminiscences.

The first case in which I put my method to a test was one of sciatica of long standing. The history of the case, and its treatment by me, is briefly as follows:

B. F., woman of 45 years, single, of feeble neurotic temperament, came under my care some time since. On making a careful examination, I found the following condition of things: She had long suffered from uterine displacement, caused, as I was informed, by an attempt to lift the end of an upright piano. From this time forth her health had gradually failed; she had lost flesh, her appetite had become poor, her sleep, which was never of the best, had deteriorated to such a degree that, as she expressed it, she was "never wholly unconscious," her menstruation was painful and irregular, and she suffered from a morbid apprehensiveness, exhibiting itself in a dread of all society

and in an inability to sleep without a light in her bedroom. The chief cause of her distress was, however, a violent neuralgia of the right sciatic nerve, which was not benefited by any of the various forms of uterine support. From this she had suffered, at intervals, for the past fifteen months. On examination, many painful points were found along the course of the nerve; the limb was maintained in a partially flexed condition most of the time; there was considerable cutaneous hyperæsthesia, but no anæsthesia; the pain, which was intense during the day, was greatly aggravated at night, and the mere touch of the bed-clothes was often sufficient to cause an intense paroxysm; the affected limb was pale and cold to the touch, the relative difference between the healthy and affected side being great.

The physician under whose care she had been previous to consulting me, had, very justly, as it then seemed to me, attributed the sciatica to the uterine displacement, and had accordingly applied a pessary. This treatment had, however, afforded her absolutely no relief. Subsequently galvanism, the actual cautery, blisters, hot and cold fomentations, the Turkish and Russian baths were all essayed, but without any considerable benefit.

When I first saw her she was suffering from a paroxysm of unusual severity, so that short periods of sleep were only obtainable by the use of copious morphine injections. The latter were made over the painful points along the course of the nerve; but what little relief the patient thus obtained was but temporary. All usual measures having failed, I finally had recourse to the following procedure:

I injected one hundred minims of a ½%-solution of cocaine at two of the more painful points along the

course of the nerve, and immediately thereafter applied a tourniquet in such wise as to interrupt the circulation in the crural artery, above the point of injection. As a rule, I believe, the tourniquet should be placed as high up as possible. In this case it was located as near Poupart's ligament as was consistent with the retention in place of the instrument.

During the first five or ten minutes little relief was experienced, but after the lapse of twenty minutes the pain had sensibly diminished, and in half an hour it had entirely disappeared. The patient complained somewhat of the pressure of the bandage, but this was relieved by placing a small roll of cotton under the tourniquet, where the latter passed over the nerve-stem. The tourniquet being removed, she declared that she felt no pain, even after the lapse of eight or nine hours. On the morning following the treatment there was, however, a return of pain. I immediately made the injections and applied the bandage as before. This time, after the removal of the tourniquet, there was no return of pain for four days. Without entering further into details, I may state that for three weeks this mode of treatment was persisted in, the incarcerated injections being resorted to whenever there was a recurrence of pain. The periods of exemption became longer and longer, until the pain finally left her, apparently for good. It is now four months since the last injection, and there has been no return of pain.

The second case in which I resorted to this method of prolonged medication was that of a lady of sixty-five, who was likewise a sufferer from sciatica of many years standing. In her case the usual expedients had been resorted to, but with little or no avail.

As in the previous case, I made copious and deep injections of solutions of the hydrochlorate of cocaine,

incarcerating the medicament by the application of the tourniquet above the point of injection. This prolonged contact of the medicament with the nerve-stem proved almost as salutary as in the previous case, but, owing to the long continuance of the painful affection, treatment was more prolonged. Finally the tendency to a recurrence of the painful paroxysm was overcome. Three months have now elapsed since the last medication of the nerve, and there has been no return of the pain.

A third case of sciatica in a man of fifty, who has been under my care for the past two months, and who has been treated in exactly the same manner as the two previous cases, exhibits every indication of eventual complete recovery.

These cases have aroused in my mind an interesting train of reflections, and I will take the liberty of stating briefly some of the conclusions to which I have been unavoidably conducted :

1. That this method of subjecting the nerve to the prolonged chemical action of an adjacent medicament possesses advantages of a theoretical and practical nature which are not easily over estimated.

2. That this prolonged medication of the nerve, by incarceration of the medicament, is incomparably more advantageous than the ancient expedient of simple injection, without incarceration by suspension of the circulation. In the former case the medicament is held in contact with the nerve for a period of time, which may be prolonged at the discretion of the physician. In the latter case it is a matter of extreme doubt whether the nerve is influenced to any appreciable extent, since the medicinal solution is at once removed by the general circulation, and has, therefore, no time to induce the requisite chemical changes in the nerve filaments.

3. Solutions of low percentage ($\frac{1}{2}\%$ or $\frac{1}{4}\%$) should be employed for prolonged medication of nerves, as it is thus possible to inject large quantities of the medicament without danger of constitutional symptoms. It is, moreover, clear that the prolonged presence of this large amount of fluid in the neighborhood of the nerve-stem must inevitably, through the operation of imbibition, profoundly affect the nervous filaments.

4. The medicated fluid should be injected as near the affected nerve as possible; but care should be exercised not to wound the latter. These deep injections may be accomplished without pain by injecting a small quantity of the anæsthetic before the point of the needle, as the latter is propelled into the tissues.

5. The treatment by prolonged medication is without danger, and therefore superior to nerve-stretching by the surgical method, which in point of reliability leaves much to be desired.

6. Cocaine is only one of many fluids which may prove useful when applied according to this method.

These, then, are some of the conclusions which have forced themselves upon me, and I confidently trust that the method of treatment above detailed may continue to yield rich results in the hands of my colleagues in the profession.

It would, of course, be possible to cite many cases of sciatica, in which, previous to perfecting local methods of treatment, I had resorted to such conventional resources as the actual cautery, the constant galvanic current, blisters and the like. The details of such cases are, however, at the present day of relatively little interest, and I therefore pass from this phase of the subject to the consideration of some of the varieties of face-pain.

Both from the intensity of the suffering engendered,

as well as from the frequency of its occurrence, facial neuralgia is pregnant with intense practical interest to the physician. I trust, therefore, that a case or two illustrating some of the phases of the affection as well as some of the methods of treatment elaborated by myself may serve a useful purpose.

V. C. E., a gentleman fifty-seven years of age, was referred to me by Dr. Cornelius R. Agnew, on account of severe supra-orbital neuralgia. There is a distinct history of malaria, which the patient contracted at the South several years since. He was thoroughly treated with quinine at that time and was pronounced "cured." Besides the supra-orbital pain, patient is frequently troubled by amblitory pains in the back and head, sometimes accompanied by flashes of heat, chills and feelings of malaise. All ordinary medication having been tried without avail, I put the patient under twenty-grain doses of antipyren three times a day in conjunction with moderate bromization. In this way the general condition was much improved, and the pains about the head (supra-orbital and occipital) were for the time completely abolished. The supra-orbital pain returned, however, shortly after discontinuance of the remedies. On making a critical examination, a point of extreme tenderness was found in the course of the nerve; and I therefore at once decided, the patient readily consenting, to resort to local medication at this point. Having carefully marked the point of tenderness with iodine, I proceeded to cocainize the part, adjusting the block and wire gauze as already described in the earlier part of this treatise. Before adjusting the gauze, however, I injected two drops of a solution of hydrocholoric acid of a considerable degree of concentration into the zone of tenderness previously marked with the iodine stain. The block and gauze

were allowed to remain in place three quarters of an hour, at the end of which time they were removed, although the anæsthetic conditions still remained. Three minutes after the removal of the gauze the anæsthesia began to abate, and five minutes thereafter it had entirely disappeared. In its place there was a feeling of slight soreness; but the characteristic shooting pains had been entirely removed. There was also some swelling of the tissues at the seat of injection, as well as slight ecchymosis. These collateral features speedily disappeared (at the end of a week). For some time longer (three or four weeks) the patient remained under my care, and although no medication other than general faradization was resorted to, there was not the slightest return of pain, nor have I since heard of any further discomfort, after the lapse of several months. Such a result as this speaks for itself; no more graphic illustration of the efficiency of the treatment adopted, where the pain is localized in a given nerve tract, could well be demanded.

M. M. T., governess, referred to me by Dr. David Webster for supra-orbital neuralgia. About two years ago patient first began to experience pain above and around the left eye. Undue tension of the internal rectus muscle having been made out by the aid of prisms, Dr. Agnew decided to cut that muscle with a view to relieving the strain. After the operation there was, I believe, some relief for a time; but the pain returning, she was referred to me by Dr. David Webster for further treatment. On examination, I found a well-marked point of sensitiveness in the course of the supra-orbital nerve. As the patient was averse to the injection of remedies, I tried all ordinary expedients, such as galvanization, counter irritation and

internal remedies of various kinds, but without attaining more than temporary results.

Finally, by dint of some persuasion, I induced the patient to consent to the trial of local medication. Sensibility was abolished by the aid of the local anæsthetic, as in the cases previously described. An injection of $\frac{1}{75}$th of a grain of pyrogallic acid (pyrogalol) was then made into the painful spot, and the gauze and block applied for three quarters of an hour or more.

On removing the gauze the usual gridiron appearance of the skin, caused by the pressure of the gauze, was present; and shortly afterwards there was some swelling of the part, which, however, disappeared entirely in the course of a few days. The slight superficial soreness which almost always follows this plan of treatment also speedily subsided, and with this restoration there was a concurrent disappearance of every vestige of neuralgic pain. This exemption lasted until the famous "blizzard," when the patient having contracted a severe cold, there was some slight return of pain, not only in the supra-orbital region but in other parts of the face. This condition was, however, at once relieved by ten-grain doses of antipyren, which the patient was nevertheless obliged to discontinue on account of her extraordinary susceptibility to the remedy. In her case even five grains three times a day were sufficient to cause the characteristic rash.

A tendency to persistency about the internal canthus having been noted in this second painful attack, I decided to make an injection into the painful zone at this point. Although, in this instance, it was impossible to apply the gauze effectively, I succeeded nevertheless in arresting the pain, as I trust permanently. there having been no complaint since.

C. C. T., a lady of sixty-three, came on from Green-

field, Mass., to consult me for a severe form of tic douloureux, the pain being located in a circumscribed spot, about the size of a pea, at the posterior aspect of the upper alveolar process. She has no teeth in the upper jaw, and the gums are retracted and shrunken. Every known remedy having been exhausted, I endeavored to make injections into the painful spot, but at the first attempt the hypodermic needle was broken, in the endeavor to penetrate the hardened gums. A second attempt with a stronger needle resulted more fortunately, and I succeeded in depositing about ten minims of the fluid in the painful region. No relief whatever followed, however, owing to the fact that the medicinal fluid was not taken up by the hardened tissue.

I next saw the patient in consultation with my distinguished friend, the late Dr. Theodore R. Varick, and it was decided to loosen the gum by the aid of the elevator. This was accordingly done ; but the result, as before, was *nil.* Had the patient not been so advanced in life, I should have advocated extirpation of the nerve, or at least its second branch ; but this, under the circumstances, was deemed hazardous, more particularly as the patient was in a state of debility.

There being no alternative, I put this good lady on whiskey, and insisted upon her taking it in sufficient quantities to deaden the painful paroxysms, of which she had from forty to fifty attacks a day. Later twenty-grain doses of antipyren four times a day were ordered, in conjunction with tonic treatment and the local application of steam to the gums. From these latter expedients she experienced considerable relief, but I was never able to wholly break up the attacks.

This case is instructive as offering an illustration of a class of cases, in which I have been unable to apply the principle of local medication to much purpose.

I now desire to say a word concerning the endermic use of remedies in neuralgia, and more particularly of the application of pyrogalic acid and cocaine in this manner.

It has long been known that chemical substances, particularly in solution, when brought in contact with raw surfaces are readily absorbed. Iodoform and carbolic acid poisoning, as the sequence of too copious an application of these substances about wounds, afford familiar illustration of the principle involved. Likewise, when the skin is denuded of its epidermal shield, it becomes at once pervious to substances brought in contact with it. By perviousness of the skin is meant that the sub-epidermal vessels absorb those fluids which are brought immediately in contact with them. Upon the facts above detailed is founded what is known as "endermic" medication, a procedure which enjoyed considerable popularity in the profession some years ago. So far as I am aware, cocaine has been used in this way to but a limited extent, and then only in a primitive fashion. Without claiming any great credit for originality, but guided rather by the desire to be of some slight use to those of my friends who may have occasion to resort to local anæsthesia for purely medical purposes, I will describe briefly the method of endermic[1] administration which I have found most effective: I first remove the epidermis by the aid of vesicating collodion (Squibbs'). The denuded surface is then covered with an india-rubber membrane. The size of the membrane should be such that its edge projects somewhat beyond the raw surface. By the aid of a good adhesive preparation, the edges (see cut, *C*) of the membrane are securely glued to the sur-

[1] First described by me in the "Journal of Surgery and Antiseptics" for January, 1888.

rounding unbroken skin. Should the adhesive material prove incapable of keeping the membrane in firm contact with the skin, a ring composed of thick wire may be placed upon the edges of the membrane and caused to exert firm pressure upon them by the aid of a band. As an additional precaution the edge of the membrane may be sealed with collodion.

Through a metal nipple, provided with a screw-cap, and situated in the centre of the india-rubber, cocaine may be introduced beneath the membrane. I usually employ for the purpose an ordinary medicine dropper. Should there be pain in the part, as in neuralgia, it generally disappears in a relatively short space of time—in fact, as soon as a certain amount of the anæsthetic has been absorbed.

The first case in which I had occasion to make trial of the above method was that of a woman who had long been the victim of neuralgic attacks. As a rule, the pain was most acutely felt about the temple, extending backward toward the occiput, and this was the case when I saw her. By the aid of vesicating collodion, I removed the epidermis from her temple to the extent of a space about the size of a quarter of a dollar. Over this denuded portion of the skin I stretched the india-rubber membrane and secured it in place as above described. Fifty minims of a two-per-cent. solution of the hydrochlorate of cocaine were then placed beneath the membrane and the cap screwed down. Ten minutes later the pain had begun to decrease, and twenty minutes thereafter had entirely disappeared. In spite of this favorable outcome, I nevertheless allowed the membrane to remain in place for the following three hours, replenishing the anæsthetic through the metallic nipple every hour. During this time there was entire immunity from pain, and,

so far as one can perceive, a complete cure has been effected. But, even should there be a recurrence of pain at some future time, it would be a perfectly easy and proper expedient to repeat a procedure which has already yielded so good a result. In this connection, I would observe that the greatest care should be exercised in securing the membrane to the skin, so that there shall be no leakage. A good india-rubber adhesive mass is the best substance which I have yet been able to obtain; but I am in hopes of finding something still better in the course of time.

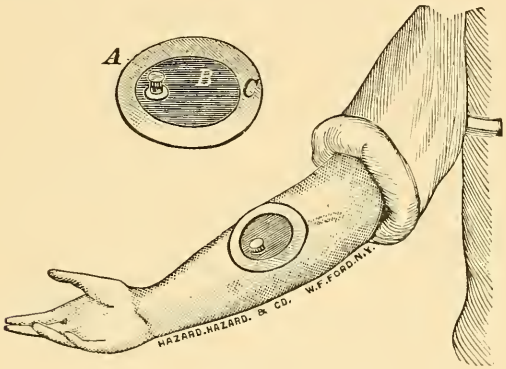

Fig. 7.

The second case in which I tried this method, was one in which there was localized hyperæsthesia of the fore-arm subsequent to hemiplegia. Throughout a district three and a half inches long by two in breadth, the epidermis was removed at regular intervals in pieces about the size of a pea; so that, after the completion of the operation, the skin looked somewhat like a sieve. Over this district the rubber membrane was stretched (see cut): and, being secured as before, the anæsthetic was introduced through the metal nipple (*A*) and the cap screwed on. The rubber blister (*B*)

was allowed in this case to remain in place for two hours, during which time there was relief from all hyperæsthetic symptoms. On the following day, as there was a return of the abnormal sensitiveness, I re-applied the membrane, being careful, however, to duly prepare the denuded surfaces beforehand, as follows:

TOILET OF THE DENUDED SURFACES.

Since, after the lapse of several hours, there is an exudation of serum, followed by the formation of a firm network of fibrin, and since moreover this fibrin interferes greatly with the absorbent qualities of the blistered surface, it is necessary to remove the same, if the denuded surface in question is to be further utilized. To this end, I am in the habit of introducing through the metal nipple a fine camel's-hair brush, saturated with a diluted solution of hydrochloric acid, to which a little pepsin has been added. By the application of this solution to the denuded surfaces, the fibrin is readily dissolved, the healing process broken up at its inception, and the denuded surfaces placed once more in a receptive condition.

The second case just referred to is hardly a fair test of the permanency of the effects to be anticipated from this method of treatment, though it abundantly illustrates the correctness of the principles underlying the procedure itself.

The first case, on the contrary, affords a good illustration of what may reasonably be anticipated from this mode of treatment in certain phases of tic.

I trust that, in giving a synopsis of the above cases, I have not trespassed too much upon the patience of the reader. To what has already been said, I desire merely to add the statement that when the pains are diffuse in character, the painful points not well marked,

and in short the reflected pains lending a general character to the affection, antipyren is the remedy *par excellence*. As an adjunct of great value to all forms of local treatment it is also of the greatest possible advantage; and the physician should have no hesitancy in thus resorting to it.

PART III.

HISTORICAL.

CONSIDERATION OF METHODS OF TREATMENT HERETOFORE PROPOSED.

CAPTTER XX.

ELECTRICITY.

It now remains to consider, in a general way, and from a more or less historical standpoint, a number of remedies which from time to time have been advocated by various writers in the treatment of neuralgia. I would not for a moment, however, have the reader imagine that I myself am an advocate of all of this polypharmacy. From what has already been said it will readily be perceived that I entertain quite definite convictions as to the most philosophical method of treating this painful affection.

At the same time I deem it but just to present a general survey of the principal points which have characterized the evolution of this branch of therapeutics. If the brief comments which I shall offer thereupon from time to time are often tinctured with ill-disguised pessimism, it is because I have so frequently seen many of these remedies fail utterly both in my own practice and in the hands of others.

Among the more prominent remedies employed by modern physicians, none has given rise to more discussion and conflicting testimony than Electricity. Both the galvanic, the induced and the static currents have been recommended. When the continuous galvanic current is employed the cathode is placed upon the sensitive points, while the anode is applied as closely as possible to the centres (or upon the sternum, according to some authors).

The faradic current is usually employed in conjunction with the wire brush, the latter being directed along the course of the affected nerve-stems. As regards the relative value of the two currents preference is undoubtedly to be given to the galvanic, on account of its smaller tension.

Where the cause of the disease is profoundly located in the central nervous system or in the nerve-roots, the galvanic current sometimes proves useful. Again, when a powerful "catalytic" effect upon nutrition is desired, the galvanic is to be preferred to the faradic current. As a matter of course, however, little permanent good can be hoped for in those cases where the affection is due to coarse anatomical changes of the brain or cord.

On the other hand, in the idiopathic varieties of neuralgia—those in which the pains are traceable to rheumatic or neuritic causes—the results obtainable from the employment of the galvanic current are occasionally good. Cures are, indeed, sometimes effected in a short time; but such cases are exceptional.

The testimony of a large number of neurologists bears witness to the value of electricity in certain phases of neuralgia; it cannot be said, however, that the therapeutic virtues of this remedy are displayed in all phases of the affection.

CHAPTER XXI.

ELECTRICITY, CONTINUED.—SIMULTANEOUS APPLICATION OF PRESSURE AND GALVANISM.

Of much greater value than the application of galvanism alone is its employment in conjunction with a considerable degree of pressure upon the affected nerve filaments. In order to apply mechanical pressure, and at the same time pass the current through the affected nerve-stem, I have had constructed the following simple device:

A strong band of leather provided with an adjustable buckle is transfixed by a screw, which is imbedded in an appropriately constructed metal garniture. One end of the screw is ovoid in shape and is covered with chamois skin, thus constituting a small electrode. To the other end of the screw is secured a tranverse cross-bar, which serves as a handle. This extremity of the screw is also provided with an appropriate mechanism for attaching the end of an ordinary conducting cord.

In order to employ the apparatus, the strap is passed around the limb, in which the affected nerve is located, and secured by means of the buckle. The ovoid electrode is then placed over the most centrally located painful spot, and the screw is rotated until as much pressure is exercised as the patient can endure. In order to make this mode of treatment more comfortable, I have recently resorted to the expedient of making superficial and deep injections of cocaine into

the part before applying the pad; and I may add that I have found this a most useful expedient, especially in the treatment of sciatica. To continue the description, the pad being properly adjusted, the disengaged end of the screw is then connected with the positive pole of an ordinary galvanic battery. An ordinary flat sponge electrode is then secured over some other portion of the continuity of the nerve or its branches by means of an elastic strap, and connected with the negative pole of the battery. Having immersed the plates of the battery, the current is gradually increased until an intense burning sensation is produced.

The first sitting should be brief in duration—from three to five minutes; but upon every subsequent occasion the application should be prolonged. It is thus possible to progressively increase the duration of the applications, until finally from fifteen to twenty minutes are endured. This, however, is only feasible in those cases in which the susceptibility of the nerve-stem to pressure and to the influences of the current becomes gradually less acute. Where the *points douloureux* show an undue tendency to persist, only short applications of from three to five minutes at a time are as a rule possible.[1]

For making prolonged applications about the cheeks, I employ a clamp electrode (Fig. IX), which, by the rotation of a screw embraces the cheek between two sponges (Fig. X). Each sponge is, of course, connected by a conducting cord with one of the poles of a galvanic battery. By a simple arrangement a considerably larger external sponge than the one seen in the cut may be adjusted.

[1] In old cases of sciatica and tic douloureux I have, however, on several occasions made applications lasting from half to three-quarters of an hour, and even longer, with excellent results.

I have also employed this appliance in the treatment of facial paralysis.[1]

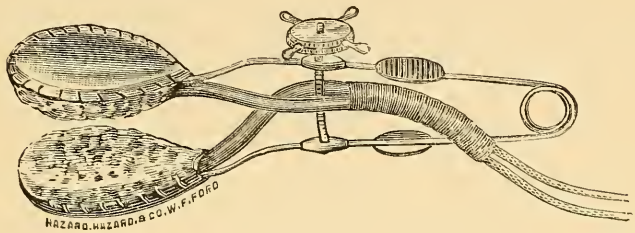

Fig. 9.

There can be no doubt that the electric current when thus employed, modifies the abnormal nutritive

Fig. 10.

conditions of nerves, allays persistent hyperæmic and inflammatory conditions, and thereby diminishes the

[1] "The Medical Register," May 5th, 1888, page 413 *et seq.*

excitability of the sensory nervous system. The precise manner in which these beneficial changes are effected must, however, remain a mystery until experimental pathology has done more for our enlightenment.

CHAPTER XXII.

NARCOTICS AND SEDATIVES.

The second class of remedies, to which a prominent place must be assigned in the treatment of painful affections, constitutes the group of narcotics and anæsthetics. Not a little of the success attending the employment of these agents is attributable to the improved methods of administration, which have been introduced during the last few years.

Foremost among the means at our disposal for allaying pain are opium and its alkaloids. The researches of Bernard have shown that opium depresses the irritability of the sympathetic system, and particularly that portion of it which supplies the submaxillary gland. The first effect of opium, especially when administered in small doses, is to increase the degree of irritability; but the primary effects soon give place to well-marked symptoms of depression.

If large doses be given at once, the state of depression is developed so rapidly, that the primary stage of irritability is evanescent in character or entirely unrecognizable.

These facts afford a substantial basis upon which to found rational rules for the administration of the drug. When the nervous system is depressed, as in various exhaustive conditions of the brain and cord, the remedy should be given in small doses, in order to obtain its stimulating effects; but when the irritability of the centres and peripheral apparatus is unduly increased,

as in neuralgia and various other disorders, it should be given in large doses, in order to obtain the best results. There can be no reasonable doubt that much of the good obtainable from the use of narcotics in painful affections is attributable to the benefits arising from increased sleep, during which trophic and irritative disturbances are corrected. This aspect of the question has, up to the present time, received far less attention than it deserves.

The best manner of administering morphine, the alkaloid of opium, which of late years has obtained such a high position among the resources of the pharmacopœia, is by the means of the hypodermic syringe. When it is desired to exert a more or less general effect upon the nervous centres, the point at which the injection is made is not so much a matter of consequence as where a more local action is required. Any spot about the abdomen or arm, where the skin is at once thin and loose, and where there are few veins, will do.

It is usually well to begin with a dose of from one-sixth to one quarter of a grain, and increase the same as required. When the effective dose has been ascertained, it may usually be employed for a considerable period without material increase. By degrees, however, the system becomes habituated to the remedy, so that in the course of time it becomes imperatively necessary to increase the dose in order to obtain the requisite physiological effects.

It is well known to most physicians that the injection of morphine about the head and neck may sometimes be accompanied by transient sensations of faintness and anxiety, and even by confusion of ideas, sudden drowsiness simulating stupor and vomiting. These symptoms are usually devoid of any ominous significance, and since they soon pass off, no particular

measures for their removal need be adopted. Moreover, if the patient has been previously apprised of the possibility of their occurrence, he is liable to experience no undue apprehension, and all danger from the effects of sudden fright are consequently removed.

As a rule the injection is not required above once or twice a day, though where the pains are unusually severe the operation may be demanded oftener. Care should always be exercised to give the remedy as infrequently and in as small doses as possible, with a view to obviating the dangers of the morphine habit. If we succeed in suppressing the paroxysms of pain for a number of days consecutively, the possibility of eventual cure is of course proportionately enhanced.

A protracted use of large doses of morphine has the effect of thoroughly habituating the patient to the drug, so that the system not only thoroughly accommodates itself to the remedy but finally craves it as a physiological requisite. As a consequence of this state of things it is impossible to suddenly withdraw the drug from those long accustomed to its use, without producing a series of irritating and even dangerous symptoms. When thus deprived of the accustomed narcotic, such persons become weak, irritable and lose flesh rapidly, and if not sustained by copious stimulation they soon succumb.

For my own part, I have had much less occasion to resort to morphine or any other preparation of opium since I have made use of the methods of local medication of the affected nerve-stems described at the beginning of the section on treatment.

This ability of the physician to dispense in a measure with the aid of narcotics is not the least advantage offered by this mode of treatment.

The other preparations of opium, such as codeine,

narcotine, and narceine have not met with an extensive employment in neuralgic affections, and morphine must still be regarded as the most important alkaloid of the opium group.

Of the remaining narcotics atropine, or belladonna, is worthy of special consideration, in connection with the therapeutics of neuralgia. The action of this drug is powerful, and it has been known to allay pain in cases where the administration of morphia has been entirely without result. Owing, however, to its extremely poisonous nature, even when administered in small doses, it should be resorted to only in cases where other means have failed.

Atropine is said to increase the irritability of the gray substance of the spinal cord, and its action upon the vaso-motor and respiratory centres is particularly pronounced. By stimulating the centre of the cardiac or accelatory nerve it acts as a powerful heart tonic, and Harley [1] has recommended it in this connection.

It has long been customary to employ narcotics in neuralgic affections in the form of various ointments; but of recent years the practice has been more or less neglected. An explanation for this is found in the difficulty experienced in causing these ointments to penetrate the stratum of epidermal cells. I have found that the efficacy of all such preparations is greatly enhanced by removing the superior layer of dead epidermial cells before applying the ointment. Moreover, I have observed that if the skin be in a state of more or less congestion, the efficacy of the ointment is correspondingly enhanced.

Acting upon these two observations, I have elaborated the following method, to which I invariably

[1] Harley on the Action and Uses of Belladonna, Braithwaite's Retrospect, Vol. LVII., 1868.

resort where it is desirable to utilize the soothing properties of narcotic ointments to the fullest extent. With a piece of ordinary window glass, the superficial strata of epidermal cells above the affected part, are carefully removed by scraping. A series of dry cups is then applied, and allowed to remain in place until the entire cutaneous area of the affected locality is in a state of congestion. The skin being sufficiently livid, the cups are removed, and the ointment applied and thoroughly rubbed in with a piece of chamois skin. This procedure should be repeated, if necessary, several times each day. Narcotic plasters may be applied in this manner, and allowed to remain in place for a considerable length of time, but, as a rule, they will be found to be less efficacious than the ointments frequently applied.

The remedies best suited to be applied in the form of salves in neuralgic affections are veratrine, morphine, belladonna, aconitia and extract of opium.

Aconitia (one part to thirty) should be rubbed into the painful areas until numbness is induced.

Veratrine (one part to twenty-five) may be applied twice or thrice daily, care being taken to continue the frictions until pricking sensations are experienced. Erb recommends one part of belladonna, four parts of glycerine and four parts of starch, the ointment to be applied on a compress or rubbed into the painful cutaneous districts.

Where the paroxysms of pain are particularly violent and protracted, the employment of anæsthetics may be indicated. Chloroform and ether may be administered in the form of ointments, internally or by means of inhalation. As a rule, the latter method is to be preferred. The inhalations should not, however, be carried to such an extent as to produce profound

anæsthesia, but rather only to a sufficient degree to alleviate the intense pains. When thus administered they may be continued for almost indefinite periods, provided there is absence of cardiac or other organic affection.

The chief objection to many general anæsthetics is the evanescent nature of their effects, which, when the inhalations are discontinued, soon pass off. It has been alleged that the paroxysms are much increased in violence after the employment of anæsthetics; but I can recall no instance of the kind within my own experience.

Hydrate of Chloral administered in large doses induces profound coma, but when given in moderate quantities it rapidly produces sleep. During the continuance of its effects reflex action and sensation are more or less diminished, and death is caused by paralysis of the heart or complete arrest of respiration. The effects of the remedy are in great measure due to its action upon the cerebral protoplasm, and not to any influence which it may be supposed to exert upon the intra-cranial circulation, I have had occasion to express my convictions upon this point on many previous occasions, not only with respect to chloral, but also with regard to all anæsthetics. The action of chloral upon the sensory apparatus precedes its effects upon the central motor mechanism. This is perhaps owing to the greater facility with which endosmotic processes are accomplished among the sensory ganglia.

The degree of vascularity of an organ has also much to do with its amenability to narcotic influences. It will be readily understood that such must be the case, when it is borne in mind that the greater the volume of blood circulating in an organ, the greater will be the

amount of any narcotic conveyable to that organ in a given length of time.

However impotent chloral may be to allay pain in very severe cases of neuralgia, there is no denying the fact that its administration in many cases is followed by excellent results. These good effects are not attributable to any special anodyne influence of the remedy, but rather to its immediate and powerful hypnotic action. How important the element of sleep is in severe cases of neuralgia cannot fail to be appreciated by those who have marked the rapid deterioration that takes place in those suffering from the obstinate insomnia induced by severe and prolonged pain. While treating the painful paroxysms with every resource at our command, care should be exercised to promote periodic sleep, since only thereby is it possible for the patient to counteract the devitalizing influences of severe and prolonged pain.

Besides the remedies already discussed, a vast number of other substances have been recommended in neuralgic affections from time to time. It would be a waste of time, however, to attempt to enumerate them all, and I shall therefore content myself with referring to those of most importance.

Bromide of Potassium is extremely valuable in those cases characterized by unusual irritability. It should be given during the day in moderate doses (10 grains), and supplemented, where there is pronounced insomnia, by a small dose of chloral exhibited shortly before retiring. The tincture of hyoscyamus (in drachm doses) may be substituted for the chloral with advantage in some cases.

CHAPTER XXIII.

OTHER REMEDIES WHICH HAVE BEEN RECOMMENDED IN THE TREATMENT OF NEURALGIA.

Phosphorus has been given with good results in those cases of neuralgia characterized by a more or less exhausted condition of the central nervous system, or by general or local cerebral anæmia. The dose may be varied from one-fiftieth to one-twenty-fifth of a grain.

Quinine has been recommended by a number of excellent authorities, among others by Erb and Trousseau. The former has found it of service when combined with small doses of morphine (quinine three grains, morphia one-sixth of a grain).

Arsenic unquestionably occupies a high position among anti-neuralgic remedies. It may be given in the form of Fowler's solution in doses of from two to eight drops three or four times a day, the amount *per diem* being gradually increased. The hypodermic exhibition of the remedy possesses certain advantages, and may be resorted to in cases of stomachic trouble where the introduction of remedies *per orem* is contra-indicated. Arsenic possesses unusual efficacy in cases characterized by sanguineous impoverishment, as well as in those exhibiting marked symptoms of cerebral or medullary exhaustion or both.

Iron in its various preparations, and particularly the chloride salt, is of no little value in treating those cases of neuralgia in which anæmia and a general

devitalized condition of the organism are prominent features. There is nothing, however, of a specific character in the action of any one of the numerous ferruginous preparations; only in so far as they affect the nutritive conditions of the organism at large are they to be recommended.

Strychnia may be given hypodermically or in combination with the preparations of iron. I prefer the former method of administration. What has been said with regard to the various preparations of iron applies in a general sense to the administration of strychnia. General anæmia or exhaustion of the vital resources of the brain or spinal cord are the primary indications for its administration.

Zinc has been extensively recommended, and I have seen good results from its employment, especially when combined with the extract of hyoscyamus. Too much, however, should not be anticipated from the zinc preparations, on account of the uncertainty of the indications for their administration.

Valerian is an excellent general sedative to the nervous system, but is devoid of any well-marked narcotic effects. It has been recommended in various head-pains, hysteria, hypochondriasis, nervous irritability and likewise in the majority of neuralgias. I have seen the best results from its employment in those cases of neuralgia in which a strong hysterical element was present.

VERATRIA, IODINE, CHLOROFORM, TURPENTINE, ETC.

Embrocations of the above are often effective in the milder forms of the affection, but usually fail to afford relief in severe cases. On the other hand, the cerate of cantharides often proves efficacious where other

vesicants have failed. There is nothing, however, of a specifically tonic influence in this, as some observers maintain, but the results are doubtless entirely attributable to the derivative action of the remedy.

As we have already had occasion to observe, the electric brush and moxa often transcend in efficacy the results obtainable by other derivatives; and since electric apparatus has become so widely disseminated these methods of treatment may be employed by those who place faith in derivatives.

Of late years the static electric current has been recommended in the treatment of painful affections, and the results obtained in some cases of peripheral neuralgia are occasionally sufficiently striking. Dr. William J. Morton has done much towards investigating the therapeutic qualities of static electricity, and a perusal of his writings upon this subject will be found instructive.

I have already had occasion to refer to a method devised by myself for treating peripheral neuralgia by the application of a certain degree of pressure to the affected nerve-stem, while at the same time the electric current is passed through the nerve at the point of pressure. The good results frequently obtainable by this mode of procedure are perhaps attributable in part to the powerful counter-stimulation; and probably not altogether to the temporary interruption of sensory conduction by pressure.

What is true of the combination of galvanism with pressure applies in a limited sense to the application of pressure alone—a sufficiently ancient expedient, by the way.

On the whole, however, not much of permanent good can be expected from the application of simple pressure alone; but on the other hand, I have seen

considerable and permanent benefit result from the systematic and persistent employment of galvano-pressure, as described at the beginning of this chapter.

Baths.—Baths hot and cold have long been employed in neuralgic affections. As a rule hot baths will be found more serviceable than cold; this applies with particular force to those cases in which a rheumatic element is discernible. On the other hand, tepid and moderately cold baths are sometimes of use in the neuralgias occurring in hysterical and neurotic women. In my own practice, I have come to regard the Turkish and Russian baths with special favor, particularly when combined with subsequent local massage and frictions. Besides hot air and steam baths, various mineral waters have been employed in neuralgic affections with more or less success. Where the general system is greatly debilitated ferruginous waters may be given, and when combined with favorable atmospheric conditions and appropriate diet they often prove valuable.

Treatment by Freezing.—This is quite an old expedient, which has lately been revived by several physicians. I have not, however, been able to discover that these recent undertakings differ essentially from the exploits of the older writers.

In common with other neurologists, I have at times had occasion to apply cold to the spine and peripheral nerves. Sometimes I have employed Chapman's ice-bag, at others I have resorted to ether spray. In either case it has always seemed to me that I was unable to produce in full measure the benefit of the cold applications. This applies with special force to those cases in which I have attempted to treat neuralgia by local freezing. The poverty of effect sometimes witnessed in such cases I have been led to ascribe to the

antagonistic action of the local blood stream. By the antagonistic action of the blood, I mean the continual raising of the temperature occasioned by the uninterrupted accession of warm blood to the part.

To overcome this difficulty, I have resorted to the simple device shown in the figure. To the end of a curved handle, eight inches long, a ring, an inch and a half in diameter, is secured by an appropriate bifur-

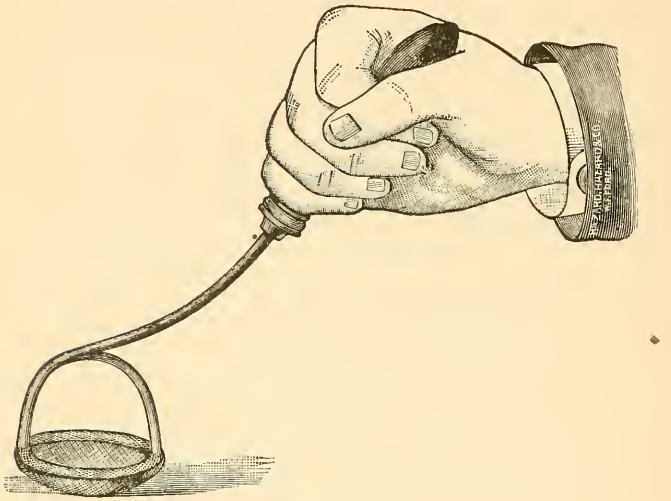

Fig. 11.

cation. This ring serves as the frame of a dome of fine wire gauze, with its convexity directed downward. In employing the implement, the convex surface of the wire dome is pressed against that portion of the integument which it is desired to refrigerate (or anæsthetize). The instrument is held with a full grasp of the hand, and considerable pressure should be exerted. If now a spray of ether, or, better, rhigolene is thrown upon the concave side of the gauze, anæsthesia may be

induced in from a second and a half to three seconds. This rapid action of the spray is readily understood, if we bear in mind that the pressure of the gauze upon the part effectually occludes the vessels below it, particularly the cutaneous capillaries. As a consequence, there being no warm blood stream to neutralize the effect of the spray, its refrigerating action is given full play, not only on the skin, but on the subjacent parts as well.

I have used this method of refrigeration, in conjunction with previous injections of weak solutions of cocaine (of one or one-half per cent.), in neuralgia. Of course, the method is applicable to any part of the surface, notably about the head. For purposes of local anæsthesia or moderate refrigeration it is unequalled. When it is employed for the latter purpose, it is usually well to resort to the ether spray, which should not be held too near the wire gauze, if we wish to avoid instantaneous congelation. When it is desired to make painless punctures with the hypodermic needle, the device will be found useful, as the anæsthesia may be limited to a circumscribed spot of the integument. It is noteworthy that insensibility of the part may be perceptibly protracted so long as the appliance is held in place.

Sometimes I have preceded the refrigerating process by the injection in the vicinity of the painful nerve of two or three drops of ordinary distilled water. The effects obtainable from this mode of operating seemed to be quite equal to those observed after the injection of an anæsthetic. It is evidently a question in these cases of a more or less permanent chemical effect combined with the mechanical element of freezing.

CHAPTER XXIV.

SURGICAL EXPEDIENTS.

It now remains to note briefly certain operative procedures, which have been resorted to by various surgeons of eminence in desperate cases of neuralgia, where the ordinary methods of treatment have been without result. In this category belong the operations known as neurotomy and neurectomy. The first procedure consists in simple division of the affected nerve, while in the second mode of operating a portion of the affected nerve is resected. Both these operations are undertaken with the view of preventing the propagation of the painful sensations to the brain: but, since in neuralgias of centric origin benefit is sometimes obtained by resort to these operations, there can be no doubt that they exercise certain derivative influences in addition to their more immediate physiological effects upon conduction.

The observation that interference with the circulation in a neuralgic zone sometimes results in complete and permanent removal of the painful symptoms has induced surgeons to ligate the arteries supplying such districts. Thus Trousseau[1] has divided and subsequently compressed the temporal and occipital arteries in neuralgia of the head; and on several occasions the results so obtained are said to have been excellent. Actuated by similar motives an eminent surgeon of

[1] Cited by Erb.

Germany,[1] ligated the carotid artery, some years since in a desperate case of facial neuralgia, with the happiest results, the cure effected being complete and permanent. Such heroic surgery requires slight commentary; it is self-evident that dangerous operations of this class should only be undertaken in cases of the most desperate character and after all other means of treatment have been exhausted.

[1] Nussbaum.

CHAPTER XXV.

SOME CONCLUDING OBSERVATIONS ON RHEUMATIC, OSTEAL, AND PERIOSTEAL HEAD-PAINS.

Rheumatic Headache.—This is probably little more than a modification of neuralgia, its prominent characteristics, tenderness of the scalp, aching of the teeth, gums and jaws, and its paroxysmal and hemi-cranial proclivities leading unavoidably to such a conclusion.

There is complete absence, as a rule, of all disturbances of the cerebral circulation, or other evidence pointing to implication of the intra-cranial structures—facts which are directly opposed to the idea entertained by some that the dura or pia are in some way concerned in the production of the morbid phenomena.

Treatment.—Unquestionably the most potent means of combating this form of head-pain consists in the application of heat to the head. This is best accomplished by means of the water cap, (see Fig. III. at the beginning of this work), through the coils of which a current of hot water is allowed to circulate. In the absence of this ingenious apparatus, an india-rubber bag or even an ordinary wine bottle may be filled with hot water and applied over the painful points with good results. Should the pain prove severe and obstinate in character, the injection of the fifth or even the eighth of a grain of morphine near the seat of pain will be found to render good service.

What has already been said regarding the treatment of neuralgia in general, applies with equal force to

many of these so-called cases of rheumatic headache. If the constitution exhibits signs of feebleness, appropriate and regular exercise should be prescribed; if there are evidences of general anæmia, iron, quinine, strychnine, milk, eggs, beef-tea, rare beef-steaks and good claret wine are indicated; and if the muscles are flabby and the sleep poor, the former condition should be met with resort to daily massage, and the latter by the procurement by proper means of an appropriate amount of brain-rest.

Osteal and Periosteal Headache.—This form of headache is due, as we have already had occasion to observe in connection with the subject of headache from disease, to secondary syphilis. This, at least, is true of the majority of cases. The treatment of such cases is largely a question of the administration of large doses of the iodide of potassium, to which small quantities of the bichloride of mercury may be added or not according to circumstances. Tonics and a special dietary may be prescribed where the general condition of the patient calls for such measures.

PART IV.

SPINAL IRRITATION.

CHAPTER XXVI.

SPINAL IRRITATION.

As the affection known as spinal irritation represents a complex of symptoms which reveals its close connection with neuralgic difficulties; and since, moreover, it is frequently found associated with various painful conditions of the peripheral nerves, it is necessary to a complete survey of our subject to consider this distressing difficulty somewhat more in detail.

Let me begin, then, by stating that spinal irritation occurs with great frequency both among men and women. The diagnosis of the affection sometimes presents difficulties, on account of its proneness to associate itself with other morbid conditions, such as neuralgia or hysteria. In typical cases, however, the symptoms observed are so characteristic, that they must undoubtedly be ascribed to a distinct pathological condition.

Symptoms.—Like spinal exhaustion the affection develops gradually in the majority of cases. The first symptoms to appear are vague pains in the dorsal region along the course of the vertebral column. These pains are usually provoked by slight fatigue, such as that induced by walking or riding or even driving. Sometimes the subject complains in the beginning of dull burning sensations between the shoulder blades or at the base of the neck; but whatever the character of the initiatory symptoms may be, the pains in the back soon become severe, and conjointly with their

evolution there is usually a high degree of mental irritability. If at this time an examination be made, certain regions along the course of the vertebral column will be found extremely sensitive to pressure or tapping. A sponge saturated with hot water, passed along the spine, evokes painful sensations; while the wire brush employed in conjunction with the faradic battery often discloses painful spots, which pressure and the hot sponge may, perchance, fail to reveal. I regard an electrical test of the degree of relative sensitiveness as of great practical importance in this as well as all other forms of obscure spinal difficulty; indeed, by the employment of this test, I have frequently succeeded in discovering localized areas of sensitiveness, which else had failed to reveal their presence altogether.

I emphasize this point merely because I believe that far too much importance has been ascribed to the results obtainable by digital pressure and percussion. In exquisite cases, however, the morbid sensitiveness is so obvious that delicate tests are superfluous. Under these circumstances the friction caused by the clothing is often intolerable, while the passage of the finger along the vertebral column reveals hyperæsthesia of the integument, which may be of great extent or limited to spots no larger than a small coin. Besides the condition of hyperæsthesia, various paræsthesia, such as burning sensations, formication, tingling and alternating feelings of hot and cold, are frequently met with. On the other hand, absolute paralysis and anæsthesia are absent. Disturbances of motility, when they exist, merely consist in a lack of capacity for the performance of operations requiring endurance;—the patient is soon weary, and even moderate use of the muscles is liable to provoke amblitory pains, which, though often intense in character, wander from one

portion of the body to another in the most unaccountable manner. Sometimes the subject complains of neuralgiform pains in the face and head, or in the upper or lower extremities ; but hardly have these sensations become established, when they gradually, and in some cases suddenly, disappear, only, however, to reappear in the form of vague, visceral, genital or vesical pains. These unstable pains are extremely characteristic, and often give rise to great discomfort and apprehension on the part of the patient, as well as confusion in the diagnosis.

Local spasms are a frequent concomitant of irritable spine. Sometimes they assume the form of fibrillary twitchings, located in single muscles, whereas in another and larger class of cases spasms are widely distributed, involving entire groups of muscles. There is nothing of a violent or epileptoid character in these phenomena ; they are usually evanescent and disappear under the influence of appropriate treatment. It may readily be conceived that the location of the symptoms exhibited in each case will depend upon whether the functional disturbance is found at the superior, dorsal, or dorso-lumbar portion of the cord.

Thus, if tenderness be found at the cervical portion of the cord, the subject is liable to exhibit vaso-motor disturbances manifesting themselves in sudden blushing and facial pallor upon slight provocation, or in an habitual frigidity of the extremities. Again, if there be hyperæsthesia above the dorsal segments of the vertebral column, digestive and other disturbances are usually present ; while should the lumbar portions of the cord be functionally disturbed, vesical derangements, in the form of an increased and frequent desire to urinate give rise to the erroneous supposition that there is paralysis of the sphincter. Should the func-

tional efficiency of the cord be more or less affected throughout its entire extent, the complex of symptoms is greatly amplified—there are palpitations, dyspepsia, spermatorrhœa, vaso-motor disturbances, fibrillary twitchings, sleeplessness and great psychical irritability. Spinal irritation, though a functional affection, is sometimes exceedingly obstinate in character; and even when we succeed in abating or removing the symptoms, they are are prone to return. Nevertheless, there is no doubt that, in the vast majority of cases, the disease is amenable to treatment, provided the therapeutic measures employed are appropriate, and at the same time rigidly adhered to, even after the symptoms have entirely disappeared.

Pathology.—The pathology of spinal irritation is not as satisfactory as might be desired, owing in part to the defective manner in which the few autopsies on record have been conducted, and in part to the extreme difficulty of obtaining *post-mortem* examinations in this, as in other benignant nervous affections. Some writers entertain the belief that the symptoms are wholly attributable to hyperæmia of the cord, while other observers are equally convinced that anæmia is the true source of the phenomena. For my own part I am entirely of the opinion that the posterior columns, and more particularly those districts of the same, known as the posterior root zones, or columns of Burdach, are involved, and I can also conceive that the posterior horn is implicated; whether the circulatory condition present is one of hyperæmia or anæmia, I am by no means prepared to say with certainty. Of this, however, I am thoroughly persuaded, that the nervous elements themselves are in a state of abnormal irritability, whatever the condition of the circulation may be. And I believe, moreover, that the question

of primary importance in treatment is the removal of such irritability by appropriate measures; and that having once accomplished this, we may confidently anticipate a corresponding amelioration in the vascular condition, be the same one of anæmia, hyperæmia or alternate hyperæmia and anæmia.[1] My views in this respect receive substantial support from the well-known relationship of the blood-stream to all active tissues. Further careful clinical and pathological observations may perhaps serve to increase our knowledge respecting the intricate morphological questions involved.

Diagnosis.—It is undeniable that spinal irritation is an affection often extremely difficult of accurate diagnosis; at least, this is true of the less typical cases. Where, however, the symptoms are well marked, less difficulty will be experienced in forming a correct conclusion as to the true nature of the affection.

The differentiation of spinal irritation from *hysteria* is, in a large number of cases, exceedingly difficult. This inability to differentiate the two conditions in certain cases does not, however, seriously interfere with the plan of treatment; for, it is but reasonable to infer, that where the symptoms of two diseases are so inextricably blended, there must be a corresponding fusion of pathological causes. On the whole, therefore, the opinion that hysteria and spinal irritation, though separate affections, are frequently associated in one and the same individual, seems plausible. Where, however, the predominant symptoms of hysteria, general spasms, globus, and paralytic phenomena are found in conjunction with only minor indications of spinal irritation, the case should be adjudged one of hysteria.

[1] The possibility that we may have to do with these evanescent changes in the circulation has already been considered by various writers.

From *spinal exhaustion*, the affection under consideration differs in this : that in the latter disorder, disturbances of sensibility predominate, whereas, in the former, marked diminution of the functional resources of the cord is the characteristic feature.

Locomotor ataxia and *myelitis*, even in their earlier stages, are not readily confounded with spinal irritation, since the lancinating pains, incoördination, and girdling sensations peculiar to ataxia are wanting ; and the same may be said of the anæsthesia, paralysis of the bladder and voluntary muscles of the limbs and contractures, which are so characteristic of the latter affection.

Spinal irritation is difficult to differentiate from *hyperæmia* of the cord, except when the hyperæmia is sufficiently intense to cause paralysis. It has been urged by a medical writer of distinction that "spinal irritation is made worse by the administration of ergot . . The reverse is true of strychnia, which, in all cases, aggravates the symptoms of myelitis, meningitis, or congestion, while it is an efficient means of cure in spinal irritation." My own experience does not accord entirely with the above; indeed, it has led me, in some cases, to a diametrically opposite conclusion. At this very moment, I have under my care a gentleman manifesting all the appearances of spinal irritation, in whom the symptoms of the affection are greatly aggravated by strychnia in doses of one forty-eighth of a grain. This phenomena is readily explained if we admit that the sensory districts of the cord are in a state of erethism. It is a matter of secondary importance whether this condition of irritability is *accompanied* by a hyperæmic or anæmic state of the cord or not.

[1] "A Treatise on the Diseases of the Nervous System." By William A. Hammond. Page 47, seventh edition, 1881.

Meningeal tumors, during their early stages, may doubtless give rise to symptoms closely resembling those induced by spinal irritation. But the disturbances produced by tumors are stable in character, and confine themselves with more or less strictness to certain districts, whereas, the migratory character of the symptoms of spinal irritation constitutes a distinctive feature.

On the whole, therefore, where severe pain of an amblitory character exists in the spine, accompanied by great tenderness of the spinous processes, but without paralysis, anæsthesia, or other severe symptom pointing to grave organic trouble, it is safe to assume that we have to do with a case of spinal irritation.

Treatment.—In the treatment of spinal irritation, the attention of the physician should be directed to those symptoms which owe their origin to the functional derangement of the cord, on the one hand, and to those manifestly attributable to a secondary condition of cerebral erethism on the other.

The removal of the local hyperæsthetic spots, though often a protracted operation, is usually attainable by the employment of a sufficient amount of patience, conjoined with appropriate local measures. Among these have been recommended counter irritation by means of blisters, or the actual cautery. I cannot say I resort to these measures as much as formerly, for reasons which I will presently state. On the other hand, the application of the galvanic current to the spine, one electrode being placed two or three inches above the painful point, and the other an equal distance below it, will be found of service in many instances. The applications should last from fifteen minutes to half an hour, and should be undertaken at least once a day. General faradization also yields excellent results, espec-

ially in cases of debility and anæmia. Of internal remedies, iron, quinine, and zinc will be found most useful, where the condition of the stomach will permit the employment of medicine.

Neuralgic pains, stomachic difficulties, and other complications should be treated symptomatically in the order of their occurrence. We have already alluded to the secondary condition of cerebral erethism, manifesting itself in insomnia and extreme mental irritability. These latter symptoms exert an exceedingly prejudicial influence upon the general health of the patient, and serve to sensibly diminish the prospects of a speedy recovery; and they should, therefore, claim the particular attention of the attending physician. For an extended account of the measures to be adopted in the treatment of the various derangements of sleep, I would refer to the special chapter upon that subject at the end of this work, and also to my former publications.[1] As regards the irritability, we would recommend the employment of the bromides, Mariani's coca wine, and, where there is no tendency to vaso-motor derangements (cerebral hyperæmia), stimulants may be administered in moderate quantities. And here, I would enter a protest against the extravagant and hysterical utterances of certain persons regarding what they conceive as dangerous attributes of the coca-preparations. In this matter, I agree with Hammond, that there is no foundation, whatever, for such apprehensiveness. I usually give brandy, whiskey, or rum; or, where the stomach will bear it, Burgundy or Bordeaux, which may be taken at dinner. The administration of stimulants is, how-

[1] "Brain Rest, being a Disquisition on the Curative Properties of Prolonged Sleep." By J. Leonard Corning, M. D. New York: G. P. Putnam's Sons, 1885. Second edition, page 36, *et seq.*

ever, often impossible, owing to extreme susceptibility.

After treating several cases, the physician inevitably becomes aware of the fact that in a certain proportion, his efforts do not meet with complete success; there is, in a word, an inordinate persistence of soreness and pain on pressure above the vertebræ—a condition discouraging at once to physician and patient. In such cases, I have frequently resorted to local medication of the cord by means of deep injections between the vertebræ of the hydrochlorate of cocaine, in solutions of varying strength. The hyperæsthetic spots are those which I usually select for the injections, but I have no hesitancy in making from six to one dozen or more such injections along the course of the spine. Care should be exercised, in making these injections, to place the needle as near the ligamentum insterspinosum as possible.[1]

The results obtained by this plan of treatment are often astonishingly favorable; and it is a matter of surprise to me that in the face of the excellent effects obtained by local medication of nerves, literature contained nothing concerning the application of this principle previous to publication of my first paper.[2] I will merely add that in the *New York Medical Journal* for November 6, 1886, I have described a painless method of anæsthetizing the skin which I believe is destined to prove an important aid in the treatment of hyperæsthetic conditions of the nervous system.

As the method of local medication here referred to

[1] For the benefit of those who are interested in the development of more potent methods of affecting the cord in disease, I would refer to my article contained in the "New York Medical Journal" for October 31, 1885, and also to my monograph on "Local Anæsthesia." New York: D. Appleton & Co., 1886.

[2] Op. cit.

is destined, in my judgment, to render good service in these obstinate painful conditions of the cord, I propose to discuss the procedure at length, more particularly with a view to elucidating the technical points involved. I desire, also, to show by what simple means it is possible to deposit the medicinal substance in large quantity, in the immediate vicinity of the spinal cord, and yet avoid the slightest danger of wounding the latter.

Some time ago, in an article published in the New York *Medical Journal* for October 31, 1885, I showed that when a given amount of a medicament is injected into the vicinity of the spinal cord certain modifications in the functions of the latter may be induced.[1]

Thus, when strychnine is injected in this manner, the functions of the cord, and notably the reflexes, are greatly exalted; much more so, in fact, than if the medicament had been simply injected into the general circulation, as in ordinary hypodermic medication. On the other hand, the modifications in function which I observed after injection of an anæsthetic, such as cocaine, were sensory in character—such, for example, as more or less complete anæsthesiæ, tingling, numbness, and various other paræsthesiæ, these phenomena being principally confined to the parts below the point of injection. The line of argument which led up to these results it is not necessary for me to detail on this occasion; enough, that the experiments, which were at first conducted on dogs, were afterward verified in man and the expedient has since been resorted to on several occasions. I was careful, too, to point out that this principle of medication offered an admirable and heretofore unsuspected and potent means of treating cer-

[1] Read before the Medical Society of the State of New York, February 7, 1888.

tain derangements of the spinal cord. Thus, it was shown that the painful phenomena which are present in spinal irritation may be combated by resort to this exceedingly direct and effective therapeutic procedure; and to this I may add that the permanency of the effects produced are enhanced by the combination of cocaine with other remedies.

Having ascertained this much, it occurred to me that it would be a matter of practical interest to pursue these researches further; accordingly, shortly after the publication of the paper above referred to, I conducted the following experiments:[1]

1. I injected a solution of sulphate of strychnine under the skin of a rabbit in sufficient quantity to induce general convulsions. I then injected a quarter of a grain of hydrochlorate of cocaine subcutaneously, but without modifying in the slightest degree the convulsive phenomena; in a word, I may state that I continued to inject this drug (hydrochlorate of cocaine) until well-marked toxic symptoms had been developed, but was not successful in modifying the convulsions to the slightest extent. The results thus obtained are directly at variance with those recorded by certain recent German observers.

2. In this experiment I again induced the convulsions by subcutaneous injections of the sulphate of strychnine, but instead of injecting the cocaine under the skin of the animal, I injected ten minims of the four-per-cent. solution *between the spinous processes of the vertebræ*. The first injection was not followed by any marked reduction in the tetanic symptoms for several minutes; therefore, at the end of ten minutes

[1] See in "The Medical Record" for March 17th, 1888, an article entitled: "A Further Contribution on Local Medication of the Spinal Cord, with Cases," by J. Leonard Corning, M.D.

I injected the same quantity as before, except that it was distributed in several inter-vertebral spaces. After the lapse of about fifteen minutes from the first injection the severity of the convulsions had markedly decreased, and the animal could be handled without their induction.

From the first experiment, therefore, it is clear that the injection of cocaine preparations into the general circulation, even in large quantities, is not sufficient to counteract the toxic effects of strychnine. Experiment shows, on the other hand, that when the drug is brought in a concentrated form into the immediate vicinity of the cord the reflex phenomena may be markedly diminished, provided, of course, that a too large quantity of strychnine has not been taken. When we consider how much greater the local than the general action of the drug is, this disparity of effect is easily accounted for. But it is in the painful affections of the cord, such as ataxia, that I believe we shall attain notable results by resorting to this direct method of medication. So convinced have I become of the necessity of making some radical departure in our mode of attacking these painful maladies, that when I had observed the phenomena recorded in my first paper,[1] I resolved, as soon as an opportunity should present, to test this local medication in the painful affections of the cord. There was one obstacle to the execution of these plans, however, which puzzled me for a long time. Briefly stated, the problem in question is this: How is the physician to know how far he may thrust the hollow needle, used in transmitting the medicament from the syringe to the vicinity of the cord, without danger of wounding the latter?

[1] "Spinal Anæsthesia and Local Medication of the Cord," the "New York Medical Journal," October 31, 1885; see also "Local Anæsthesia," D. Appleton & Co.

As I have said, this problem puzzled me for a long time; and yet there was no evading it, for I saw at once that if the procedure were to prove effective it could only be by depositing the medicinal substance as close to the cord as possible. There are not many problems in this life, however, which cannot be solved by hard and properly directed thinking, and this one proved no exception to the rule. To make a long story short, I succeeded completely; and this is how the matter was accomplished. Having examined the vertebræ of the lower portion of the spinal column, I observed that the posterior surface of the transverse process, even at its greatest depression, though almost on a level with the posterior aspect of the foramen vertebræ, did not fall at all, or, in rare cases, possibly very slightly below it. This is especially true of the ninth, tenth, eleventh, and twelfth dorsal, and of the first and second lumbar vertebræ. As soon as I had observed this anatomical coincidence, I saw at once that, in so far as the lower vertebræ were concerned, the problem of approaching the immediate vicinity of the cord with the point of a hypodermic needle, without danger of wounding it, was solved. In a word, to make the matter short, the simple technique which I elaborated on the basis of these observations is as follows:

1. I first, as a rule, induce a condition of cutaneous anæsthesia in the vicinity of the spinous processes of the tenth and eleventh dorsal vertebræ almost as large as a silver dollar. This I do simply for the comfort of the patient and for no other purpose. The electrochemical method [1] elaborated by me, or the hypodermic syringe, may be employed for the purpose.

2. I now call into requisition a fine needle, about three inches long, provided with a handle and a sliding

[1] See the "New York Medical Journal" for November 6, 1886.

nut (Fig. XII). The latter may be fixed at any portion of the continuity of the needle by means of the screw. This needle I thrust down (about half an inch laterally

Fig. 12.—Exploratory Needle.

from the spinous process of the tenth dorsal vertebræ) until the bone is reached. The nut is then pushed down till it rests lightly upon the skin, (Fig. XIII) and

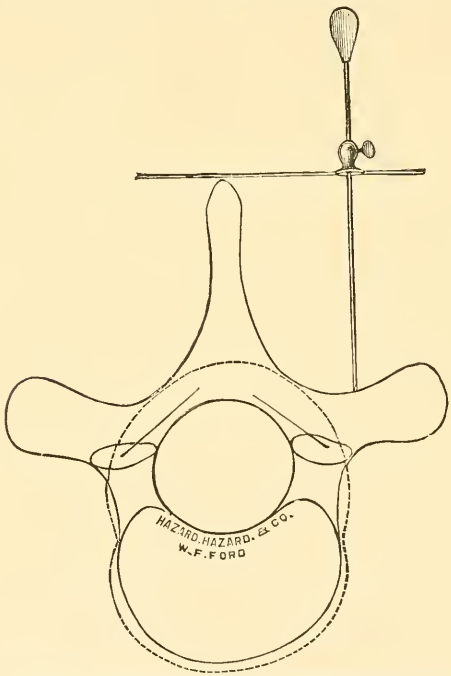

Fig. 13.—Showing Manner of Employing the Exploratory Needle.

is secured in place by means of the screw. I then withdraw the needle.

It is now clear, from what has already been said,

that the distance from the nut to the point of the needle corresponds almost exactly with the distance from the surface of the integument to the cord. To make assurance doubly sure, however, I am in the habit of subtracting two or three millimetres from the measurement thus attained

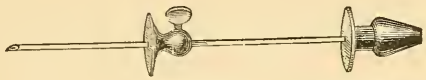

Fig. 14.—Hollow Needle and Sliding Nut.

3. Upon a fine cannula (Fig. XIV), likewise provided with a sliding nut, the distance previously noted upon the needle is measured off (minus, two or three millimetres), and the nut secured firmly in place.

4. This hollow needle is then attached to a syringe (Fig. XV) of one hundred minims capacity, filled with a

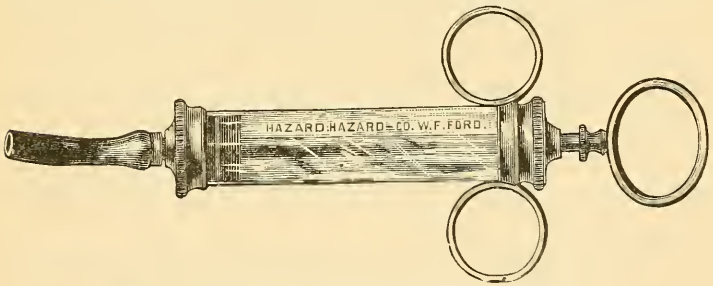

Fig. 15.—Syringe of One Hundred Minims Capacity.

one-and-a-half-per-cent. solution of the hydrochlorate of cocaine, to which is added about gr. $\frac{1}{15}$ of pyrogallic acid. I have used solutions of various strengths, but am inclined to give preference to those of one-and-a-half per cent.

5. The cannula is now thrust into the tissue between the spinous processes of the tenth and eleventh dorsal vertebræ (I have sometimes inserted it between the

ninth and tenth), until the nut, previously firmly fixed as described, rests upon the integument.[1] The contents of the syringe are now slowly emptied, and the needle withdrawn.

6. The patient should now be allowed to lie on his abdomen, with his legs hanging over the edge of the sofa or bed in such wise as to put the dorsal muscles on the stretch. This manœuvre presses the fluid in the direction of the least resistance, *i.e.* the cord, be sides causing the rigid muscles to act, in a certain sense, as an incarcerating mechanism; that is to say, that, in their rigid condition, they prevent the medicament, to some extent, from being absorbed by the tissues outside of the spinal canal. Of course, when the solution has once entered the spinal canal, we can do nothing to keep it in permanent contact with the cord. The circulation at the lower segments of the cord is, however, as is well known, extremely lethargic, so that the solution cannot be washed away very rapidly. This torpid state of the circulation, already alluded to by Brown-Séquard in his papers on paraplegia, no doubt accounts for the persistence of numbness and anæsthesia more or less profound after the injections have been made.

So much, then, for the technique of this mode of treatment. Relatively long as is necessarily the description, the execution of the manipulations themselves is by no means so difficult as might be imagined. I have employed the procedure many times, sometimes using cocaine alone, and sometimes combined with the tincture of aconite or pyrogallic acid, according to the effects which it is desired to obtain.

[1] When the injections are made in the upper and middle dorsal regions the precautions detailed above are not so necessary, though, perhaps, on the whole, they are preferable.

In the affection commonly known as spinal irritation, whether there be a condition of congestion or anæmia I care not, its effects are certainly in the highest degree beneficial, as I have already had occasion to demonstrate to my entire satisfaction in several cases. How much may be obtained in inflammatory affections of the cord only an extended experience can, of course, determine. In purely functional derangements, however, its efficacy is beyond question.

The following brief synopsis of cases will serve to exhibit the promptness and permanency of the effects often obtainable by resort to this mode of treatment.

1. Mrs. C——, a young married lady, consulted me some months since on account of severe pains between the shoulders and at the back of the neck. These pains were exceedingly persistent. They were readily evoked by slight exertion, such as bending forward, walking, or lifting small objects, and they had failed to yield to any sort of treatment whatsoever. Previous to consulting me, this good lady had submitted to an ordeal in the way of treatment which was as unique as it was ineffectual. Her back had been cauterized repeatedly; she had been plied with all manner of drugs, so that her stomach was in an exceedingly bad condition; and last, but not least, her vagina had been bedouched, besalved, and bestuffed, according to the most exacting tenets of modern uteromania. It was natural, in the face of all this, that the mind of the patient should have become somewhat hypochondriacal; and it was equally to be anticipated that her morbid reflections would centre upon the pelvic organs; so that when, during the consultation, she asked me, with considerable trepidation, whether I did not believe that she "had better have her womb cut out to cure the pain in her back," I was not inordinately astonished.

An examination of the spine revealed three exceedingly tender points at the upper and middle dorsal region. At two of these points pain was at once induced by pressure, at the third spot it could only be evoked by the application of the electric brush.

Such being about the condition of affairs, I decided, with the patient's full concurrence, to try the effect of local medication at the seat of pain.

Having filled the large glass syringe already referred to with a solution containing gr. $\frac{1}{15}$ of pyrogallic acid and one-and-a-half grain of cocaine to one hundred minims of water, I injected the entire contents of the syringe (one hundred minims) into the upper painful spot. Ten minutes later there was no pain at the point of injection; and what, at the time, seemed still more remarkable to me, the tenderness had entirely disappeared from the painful spots below the point of injection. As I now look at it, I am inclined to ascribe this striking phenomenon to the gradual deportation of the anæsthetic into the regions below the point of introduction. This explanation would seem to accord well with what we know of the distribution of the blood-vessels in the spinal canal; but I will not incur the danger of wearying the reader by further speculations on this point.

Enough that after this single injection the patient was able to execute all kinds of movements, such as bending forward, lifting objects from the floor, and the like, without the slightest pain. This exemption from suffering continued during the eleven following days, when having, as she thought, exposed herself to the effects of cold while riding in a horse-car, there was a return of severe pain. I again made an injection as before, selecting for the purpose the region about the second painful spot. A like happy issue was the

result, complete abolition of pain, an exemption which has continued, so far as I know, up to date.

2. Neurotic youth of sixteen. Has been addicted to masturbation for some years, a habit which he says he acquired at school. His parents, however, insist that he was addicted to the practice before going to school. That as it may be, there is pretty good evidence that he has masturbated more or less since his tenth year.

Six months ago I was consulted by the parents of the boy on account of a severe pain located at the lower portion of the back. On examination tenderness on pressure was found at the eighth dorsal and tenth lumbar vertebræ. When the patient attempted to bend forward the pain evoked was quite acute. Of late he has been able to indulge in walking but little, owing to the painful sensations to which it, as well as all forms of exercise, gives rise. Is sleepless, irritable, and depressed.

Most of the conventional remedies having been tried without avail in his case, I determined, his parents readily consenting, to try the efficacy of local medication. Accordingly, I injected seventy-five minims of an aqueous solution containing gr. $\frac{1}{75}$ of pyrogallic acid, and gr. $1\frac{1}{2}$ of cocaine at each point of tenderness.

In ten minutes the patient could execute all kinds of bodily contortions, such as bending forward, laterally, and even backward.

The relief lasted for hours, and, indeed, for the next four days there was marked improvement. At the end of that time, however, the local tenderness again appearing, if anything, in a more aggravated form than at first, I again made the injections precisely as before, and with the same results, except that the effects were altogether more permanent, lasting for

the following three or four weeks. A slight degree of tenderness then made its appearance, and, strange to relate, at a point higher up. An injection was at once made at the painful point, resulting, as usual, in complete abolition of all tenderness. Several months having now elapsed and no complaint having been made, except on account of occasional cutaneous hyperæsthesia, which is as usual relieved by a strip of ordinary belladonna plaster, I think that we are perhaps justified in looking upon the case as practically cured.

3. A young man, twenty-two years of age, was referred to me some time since by Dr. L. Bolton Bangs. Briefly, the patient had been operated upon for stricture by Dr. Bangs, and six days afterward developed severe spinal irritation.

More or less dull pain was felt in the lumbar region and sacrum, extending to the lower dorsal vertebræ. At the seventh dorsal vertebra pain on pressure was exceedingly acute; and from this point intercostal pains of great intensity, particularly on the left side, were radiated, so that breathing was shallow and accompanied by much distress.

Dr. Bangs had recourse to large doses of ergot, and applied the actual cautery to the back of the patient in a most thorough manner. Still, though there was apparently some amelioration, it was felt that the relief experienced was far from satisfactory.

Accordingly, Dr. Bangs, being cognizant of my interest in local medication of the cord, requested me to ascertain whether the severe pains, and particularly those about the chest, could not be relieved by local means.

Appreciating the necessity of affording as speedy relief as possible, I at once injected one hundred minims of an aqueous solution containing about one-sixtieth of a grain of pyrogallic acid, and one grain of

cocaine, into the painful zone in the immediate vicinity of the seventh dorsal vertebra.

Ten minutes after the injection had been made, the patient experienced complete relief from the intercostal pains. He could bend the body from right to left, backward and forward, and inflate his lungs to their fullest capacity without the semblance of pain. Pressure upon the seventh dorsal vertebra also failed to evoke the slightest sensation of discomfort. During the following two hours patient remained in my office, and at the end of that time, there being no sign of returning discomfort, I allowed him to walk home unattended. Three days later he again reported at my office, and, though an examination of his spine revealed some superficial soreness, the deep-seated pains were not evoked, nor had there been any return of the intercostal pains. For the relief of the cutaneous soreness the simple application of a strip of belladonna plaster was found sufficient.

The subsequent course of the case presents some interesting genito-urinary features, which I trust at some future date Dr. Bangs will elucidate with his accustomed skill. As for the spinal irritation, I feel that a cure has been practically effected, although the severe changes in temperature experienced during the last few weeks have evoked at times a slight return of soreness. This soreness has been easily controlled by moderate doses of antipyrine.

Several weeks after the above was published, patient called upon me and informed me that he had long since discontinued the antipyren, as the pain had entirely left him.

4. Old case of spinal concussion in a gentleman of fifty, who met with a railway accident some years ago. Has been under my care for many months, and,

although able to dispel the psychical depression from which he has long been a sufferer, I was, until recently, unable to abate a severe soreness at the region of the lower dorsal vertebræ. This soreness he ascribes to the fact that he was caught between two seats of the car on the occasion of the railway accident above referred to.

Having tried all the usual superficial local measures without success, I undertook, with the patient's consent, to abate the symptoms by resort to deep local medication. As in the previous cases, the injections were conducted at the seat of pain, with every precaution, and with the result of affording complete and immediate relief from the painful symptoms. Four days after the injections there was some slight return of soreness, but this was at once controlled by supplementary injections. Some weeks have now elapsed since the last injection was made and there has been no return of pain.

5. N. I., a young lady of twenty-three years of age, was brought to me in consultation by Dr. Simpson, a prominent practitioner of Massachusetts.

The following notes of her case are compiled in part from Dr. Simpson's letters and in part from my own case book. Her general health is good, appetite fair. She is well nourished, but has suffered, for the past five years, from severe pain in the head and back. On examining the spine several points of great tenderness were discovered. One of these is located at the lower cervical, one at the middle dorsal, and one at the lower portion of the lumbar region. Till within a comparatively recent period, patient has exhibited no hysterical symptoms ; of late, however, she has been troubled by occasional attacks, which are evidently of an hysterical nature. At times is irritable and depressed, and

at all times she exhibits much susceptibility to sensory impressions, and particularly to noises of all kinds. Thus, while I was conversing with her, she requested me to arrest the pulsations of a faradic battery, which, she said, caused her great annoyance. Dr. Simpson writes me that the rumbling of a cart or the sound of hammering are quite unendurable to her. "Medication has done little for her, electricity has done nothing."

She has had a good deal of cervical erosion, which has yielded well to the measures employed by Dr. Simpson. In spite of these local benefits, there has, nevertheless, been no diminution in the severity of the dorsal pains. Menstruation is regular, but occasionally accompanied by some pain. Motions of the body, such as bending forwards or backwards or towards the side, evoke the dorsal pain or increase it. The same is true of riding in a carriage.

This was substantially the condition of the patient when Dr. Simpson brought her to my office on the fifth of April, 1888.

After consultation, it was decided, inasmuch as all other remedies had failed, to resort to local medication of the cord.

The point selected for the first injection was the point of tenderness in the lower lumbar region.

A careful preliminary measurement to the transverse process having been made, one hundred minims of a 1 % solution of cocaine were injected into the painful region. As I was careful to thoroughly refrigerate the painful area with the rhigolene spray before making the injection, the pain caused by the puncture was insignificant. Shortly after the conclusion of the operation, the patient manifested great nervous excitement, and complained of sensations of tingling and

numbness in the hands and feet. There were no motor disturbances whatever.

This condition of exaltation lasted an hour and a half, when the patient was able to enter her carriage and be driven to the hotel.

On the following day I saw her for a few moments, and though complaining of slight cutaneous soreness, she declared that deep-seated pain had entirely disappeared in the lumbar region.

I have cited this case as affording a fair illustration of the persistent tendency of the analgesia evoked by this application of the drug. My case book contains the records of many other cases in which I have resorted to this mode of treatment. At some future time it is my intention to publish a tabular report of these cases.

CHAPTER XXVII.

SPINAL IRRITATION AND OTHER PAINFUL SYMPTOMS CONSEQUENT UPON SLIGHT LOCAL INJURY OR GENERAL SHOCK.

To my mind no history of spinal irritation can be regarded as complete that does not include a description of that interesting group of symptoms which supervenes as the result either of slight local traumatism or as the sequence of a severe shake or shock. These are the cases so admirably described in the fourth and fifth chapters of Erichsen's classical work on "Concussion of the Spine"—a book the importance of which as a practical contribution to the pathology of the cord is not easily overestimated. Few scientific books have given rise to more criticism than this; few have been more condemned, few more applauded. To state these facts is but another mode of proclaiming the epoch-making qualities of this admirable little volume. For my own part, I must confess to but one emotion after the perusal of each successive edition of this admirable contribution to neurological literature—that of profound admiration—a sentiment of such proportions, withal, that in its presence the merest thought of criticism would have seemed an act of sacrilege.

It is in this spirit of full acceptance, then, that I now propose to consider that particular phase of spinal concussion which makes its appearance soon or it may be a long time after general shock or slight local

injury. In order to contribute to a greater fullness and understanding of the subject, I shall cite cases from my own practice as well as some of the more graphic histories recorded by Mr. Erichsen.

Symptoms —If a man be suddenly precipitated from an elevation, and strike with violence upon the back, or if he be caught between two seats of a railway car in the course of an accident, so as to bruise, say the lumbar portion of his spine, a train of grave symptoms may be developed, pointing to profound derangement of the functions of the cord. There may be immediate paraplegia, or some other phase of paralysis; there may be retention of urine: there may be various forms of paræsthesiæ—formication, numbness or even total anæsthesia of the affected parts; or, paralysis accompanied by one or more of these phenomena. Sometimes, after some febrile disturbance, of short duration, the symptoms begin to abate, and eventual complete recovery takes place. Sometimes, however, the termination is not so favorable; there is more or less persistence of dorsal pain, with numbness or sensations of pins and needles, accompanied by depression, derangements of memory and other symptoms pointing to profound implication of the cerebro-spinal system. The spinal tenderness present in such cases is often of an exquisite and obstinate character—all the resources of counter-irritation and internal medication being usually exhausted without appreciable amelioration. Of late, I must confess, however, that I have experienced far less difficulty than formerly in controlling this local irritation. I shall take occasion to return to this point presently.

If, in addition to direct concussion of the spine, a blow upon the head has also been received, it not infrequently happens that in the course of time epilep-

tiform seizures are added to the cord symptoms, the clinical history being somewhat changed, and the prognosis thereby much clouded. Finally, the blow upon the spine may be but slight or altogether absent, the subject being merely thrown violently about as in certain railway accidents. Under these circumstances, the symptoms are often slowly evolved, and though frequently less severe than when the sequence of a direct and violent traumatism, they nevertheless partake of an insidious and lethargic character, which puts the patience of both client and physician to a severe test.

Accidents of this class have now become so common, in consequence of the manifold complications of modern society, that attention to this branch of pathology will amply repay the practitioner for any additional trouble which a proper familiarization with the subjects may entail. As already noted, the painful localities along the spine, so constant a feature of such cases, are eminently worthy of the attention of the practitioner who aspires not only to a scientific diagnosis, but to effective therapeutics as well.

At this portion of the discussion, I believe that I cannot do better than cite a case or two from my own practice, as well as from the ample experience of Mr. Erichsen.

H. C., merchant, aged 52 years, of strong, muscular constitution, consulted me in February, 1884, for a train of severe nervous symptoms, which caused great anxiety both to himself and family.

The following are the more prominent points in the history of the case:

One year previous to consulting me, he had the misfortune to travel on a railway train which met with a serious accident. The accident in question, as it

afterwards appeared, was caused by the spreading of the rails immediately in front of a long trestle-work. Several of the coaches were thrown from the trestle into the water, many of the occupants being caught between the seats or thrown about and severely injured. Others, again, were caught beneath the flying débris and drowned, while yet others succeeded in making their escape from the windows of the coach. Among the latter was a distinguished officer of the United States Army and the gentleman with whose history we are now concerned. Had the coach, after striking the bottom, not rolled over upon its side, it is probable that those within, who had not been killed outright, would have perished by drowning. As it was, a large proportion of those within the submerged cars escaped with their lives. It cannot be said, however, that these persons were all unscathed, for, though the wounds received were in most cases not serious, the after-effects caused by the violent shaking were of a severe character.

Among those who developed severe symptoms a considerable time after the accident was the gentleman who forms the subject of this brief history. On emerging from the water, he became conscious that the right shoulder and the lower portion of the back were somewhat stiff and sore. At the same time he felt a dull pain throughout the whole dorsal region. These pains and the accompanying soreness in the shoulder soon disappeared, however, and the patient was beginning to regard himself as perfectly well, when, several weeks after the accident, he complained of numbness in the third, fourth and fifth fingers, particularly pronounced in the right hand. This numbness was accompanied by tremor of both hands, evoked by every attempt to execute voluntary movements.

At the same time patient experiences "dull, tired" feelings after walking even short distances, accompanied by great mental depression. Co-existent with the above symptoms, patient has remarked a progressive decline in his sexual powers; so that, at the time of visiting me, his abilities in this direction were *nil*. The testicles seemed unusually small, the scrotum was tightly contracted about them; and, at the same time, the penis was retracted, so as to expose only about half an inch. Altogether the sexual apparatus presented the characteristics of that of a young infant. On examining the spine, no great tenderness could be discovered; but on passing the wire brush along the spinous processes, from the cervical region to the sacrum, an exceedingly tender point was discovered in the neighborhood of the eleventh dorsal vertebra. The course of this case was a long and tedious one.

Sleep being profoundly deranged, patient was placed on twenty-grain doses of the bromides, to be taken three or four times a day. Small doses of chloral were also given at night during the first few weeks of treatment, combined with the tincture of hyoscyamus. Strychnine was not well borne, and, according to the patient's statement, aggravated the lumbar pain

In order to relieve the latter blisters were applied throughout the painful region, but without greatly relieving the spinal soreness. Prolonged applications of galvanism were more effectual in relieving the irritation; and accordingly the constant current was applied every other day for two months, at the end of which time marked benefit had been obtained. The tingling and numbness of the limbs remained for some time longer; but after the lapse of four or five months, it, too, had entirely vanished. Walking had also

begun to afford pleasure, and could be indulged in without the fear of subsequent lassitude.

The most difficult complication to combat in this case was the complete loss of sexual power, accompanied by the retraction of the organ. This retraction of the penis was certainly phenomenal, as already observed. In order to remedy the condition, dry cupping of the penis was resorted to, and continued daily for over three months, and every other day for the subsequent four months. By the aid of this treatment combined with douches, the passage of the cold sound, such remedies as the chloride of gold, iron and the coca preparations, I finally succeeded in completely restoring the patient's sexual powers, so much so, in fact, that in due time a further addition was made to his family, the child, a healthy girl, weighing at birth over nine pounds.

This case affords an excellent illustration of the slow insidious onset of the affection, of the evolution of severe and obstinate symptoms without local traumatism of commensurate importance, and finally of the ultimate success attending the treatment of what at the outset had all the aspects of a hopeless case.

The patient remained under my immediate care nineteen months. At the end of that time, with the exception of occasional attacks of depression, the cure was complete. Since discontinuing treatment, I have seen the patient from time to time, and some months ago he informed me that these attacks of depression had entirely left him, and that, in short, he was as well as he had ever been in his life.

The following case of Mr. Erichsen, which I cite from his well-known work, somewhat resembles the above case, which I have taken from my own

note book; the termination was, however, not so fortunate.

"H. M. L., a surgeon, aged 43, naturally a stout, healthy man, of active professional habits, consulted me on February 22d, 1865. He stated that on October 9th, 1864, he was in a railway collision, by which he was thrown forwards, but without any very great violence. He received no blow on the back, head, or other part of the body. He was much frightened and shaken, but did not lose consciousness

Beyond a general sensation of illness, he did not suffer much for the first three or four weeks after the accident, but he was not able to attend to his business; could not collect his thoughts sufficiently for the purpose.

About a month after the accident, he began to suffer from pain across the loins. He could not walk without great fatigue. He lost strength and flesh, and his pulse became habitually much more frequent than natural, being about 98 to 100.

When I saw him four and a half months after the accident, he continued much in the same state; was quite unfit for business, and had been obliged to relinquish practice; not owing to any mental incapacity, but entirely owing to his bodily infirmities. His mind was quite clear, and his senses perfect, though oversensitive; loud and sudden noises and bright light being particularly distressing to him.

He complained chiefly of the spine. He suffered constant pain in the lower part of it, in the lower dorsal, and the lumbar regions. He compared the sensation there experienced to that of a wedge or plug of wood driven into the spinal canal. It was a mixed sensation of pain and distension. The spine generally was tender, and the pain in it was greatly increased

by manipulation, pressure and percussion. It had lost its normal flexibility, moved as a whole, so that he could not bend forward or stoop. There was no pain in the cervical region, or on moving the head.

He complained of painful numbness and formications in the right, and occasionally down the left leg. The legs were stiff and weak, especially the right one. He could not stand unsupported on this for a moment. He walked in a slow and awkward manner, straddled, and was not able to place the feet together. If told to stand on his toes, he immediately fell forward. He had lost control over the limbs, and did not know exactly where to place the feet. He had a frequent desire to pass water, suffered greatly from flatus, and had completely lost all sexual desire and power. The pulse was at 98 ; appetite bad ; digestion impaired.

I saw this patient again at Brighton, toward the end of April, seven months after the accident, in consultation with Mr. Curtis, and found that his condition had in no way improved. I saw him again in 1878 with Mr. Bellamy. He had tried to follow his profession, but was unable to do so. He had partial paralysis of the musculo-spinal nerve of the right arm, with atrophy of the muscles supplied by it. He had partial paraplegia. I believe this mischief to have been of chronic inflammatory nature ; the tenderness of the spine, the feeling of distension, the pain on movement, and the habitually high pulse, pointed in this direction."

The following is another interesting case of spinal concussion accompanied by great local tenderness in the cervical, dorsal and lumbar regions, recorded by Mr. Erichsen. As in the preceding case the evident cause was general shock.

"Mr. C. W. E., aged about 50, naturally a stout,

very healthy man, weighing nearly seventeen stone, a widower, of very active habits mentally and bodily, was in a railway collision on February 3d, 1865. He was violently shaken to and fro, but received no bruise, or any sign whatever of external injury. He was necessarily much alarmed at the time, but was able to proceed on his journey to London, a distance of seventy or eighty miles. On his arrival in town he felt shaken and confused, but went about some business, and did not lay up until a day or two afterward. He was then obliged to seek medical advice, and felt himself unable to attend to his business. He slowly got worse, and more out of health. Was obliged to have change of air and scene, and gradually, but not uninterruptedly, continued to get worse, until I saw him on March 26th, 1866, nearly fourteen months after the accident. During this long period he had been under the care of various medical men in different parts of the country, and had been most attentively and assiduously treated by Dr. Elkington, of Birmingham, and by several others, as Dr. Bell Fletcher, Dr. Gilchrist, Mr. Gamgee, Mr. Martin, etc. He had been most anxious to resume his business, which was of an important official character, and had made many attempts to do so, but invariably found himself quite unfit for it, and was most reluctantly compelled to relinquish it. When I saw him at this time, he was in the following state :

"He had lost about twenty pounds in weight, was weak, unable to walk a quarter of a mile, or to attend to any business. His friends and family stated that he was in all respects 'an altered man.' His digestion was impaired, and his pulse was never below 96.

"He complained of loss of memory, so that he was often obliged to break off in the midst of a sentence,

not being able to complete it, or to recall what he had commenced saying. His thoughts were confused, and he could not concentrate his attention beyond a few minutes upon any one subject. If he attempted to read, he was obliged to lay aside the paper or book in a few minutes, as the letters became blurred and confused. If he tried to write, he often misspelt the commonest words; but he had no difficulty about figures. He was troubled with horrible dreams, and waked up frightened and confused.

"His head was habitually hot, and often flushed. He complained of a dull, confused sensation within it, and of loud noises which were constant.

"The hearing of the right ear was very dull. He could not hear the tick of an ordinary watch at six inches from it. The hearing of the left ear was normal; he could hear the tick at a distance of about twenty inches. Noises, especially of a loud, sudden or clattering character, distressed him greatly. He could not bear the noise of his own children at play.

"The vision of the left eye had been weak from childhood. That of the right, which had always been good, had become seriously impaired since the accident. He suffered from *muscæ volitantes*, and saw a fixed line or bar, vertical in direction, across the field of vision. He complained also of flashes, stars, and colored rings.

"Light, even of ordinary day, was especially distressing to him. In fact the eye was so irritable that he had an abhorrence of light. He habitually sat in a darkened room, and could not bear to look at artificial light, as of gas, candles or fire. This intolerance of light gave a peculiar frowning expression to his countenance. He knitted and depressed his brows in order to shade his eyes. The sensations of smell and taste

seemed to be somewhat perverted. He often thought that he smelled fetid odors which were not appreciable to others, and he had lost his sense of taste to a great degree. He complained of a degree of numbness, and of 'pins and needles' in the left arm and leg, also of pains in the left leg, and a feeling of tightness, or constriction. All these symptoms were worst on first rising in the morning. He walked with great difficulty, and seldom without the aid of a stick; whilst going about a room he supported himself by taking hold of the articles of furniture that came in his way. He did not bring his feet together, straddled in his gait, drew the left leg slowly behind the right, moved it stiffly and kept the foot flat in walking, so that the heel caught the ground and the limb appeared to drag. He had much difficulty in going up and down stairs, could not do so without support.

"He could stand on the right leg, but if he attempted to do so on the left it immediately bent and gave way under him so that he fell.

"The spine was tender on pressure and on percussion at these points, *viz.*, at lower cervical, in middle dorsal, and in lumbar regions. The pain in these situations was increased on moving the body in any direction, but especially in the antero-posterior. There was a degree of unnatural rigidity, of want of flexibility, about the spine, so that he could not bend the body; he could not stoop without falling forward.

"On testing the irritability of the muscles by galvanism, it was found to be very markedly less in the left than in the right leg

"The genito-urinary regions were not affected. The urine was acid, and the bladder neither atonic nor unduly irritable.

"The opinion that I gave in this case was to the effect

that the patient had suffered from concussion of the spine, that secondary inflammatory action of a chronic character had been set up in the meninges of the cord, that there was partial paralysis of the left leg, probably dependent on structural disease of the cord itself, and that the presence of cerebral symptoms indicated the existence of an irritability of the brain and its membranes.

"I saw the patient again on April 18th, 1867, two and a half years after the accident. He then suffered much from pain in the head, and in the cervical spine. He was subject to fits of continual depression, was generally nervous and little fitted for his ordinary business, memory was defective, and ideas unconnected. The head felt hot, face had a somewhat heavy expressionless look, pulse 96 to 98, digestion bad, urine phosphatic, left leg numb, with occasional darts of pain and sensation of 'pins and needles.' It was colder than the right leg."

This case of Dr. Erichsen is exceedingly interesting, as exhibiting the profound and persistent disturbances of motility and sensibility consequent upon these severe jars, and in the absence of all evidence of direct traumatism. The persistence of the accompanying mental disturbances is another interesting feature. These derangements of memory, of concentration, of the coordinating faculty and of consecutiveness of argument closely resemble the characteristic group of symptoms present in cerebral exhaustion. I have often been struck by this resemblance, and the similitude of the phenomena has unavoidably led to speculations as to a possible identity of some of the pathological features of the two affections.

The following case, extracted from my own notebook, is a good illustration of some of the milder phe-

nomena sometimes evoked by concussion. As in the cases already cited, marked localized tenderness of the spine was present; but the condition was treated in a more direct and effective manner.

J. M., a married man of forty five years of age, of nervous temperament and slight physique, consulted me four years ago on account of a train of nervous symptoms, which caused him both anxiety and annoyance. The salient points in his case were these:

About eighteen months before consulting me he had met with an accident on the Long Branch railway. He was violently thrown about the car; his head was cut and he received a severe bruise in the left lumbar region. On extricating himself from the wreckage, he noticed that his legs felt "sleepy," and that there was a tingling sensation in the right side of the face. These sensations disappeared entirely within the following week, and he was abundantly able to resume the duties of an active business life. All went well for a time; the duties of society and business received a punctilious attention, which had never been excelled, even when the patient had been in the enjoyment of the most perfect health. Some five months subsequent to the accident, however, he began to complain of great lassitude, particularly during the early morning hours. At the same time sleep became profoundly deranged, and even when he was perfectly certain that he had slept for a few hours he complained that his sleep "did him no good." Formerly of a cheerful disposition, he became the victim of protracted periods of depression; his memory, of good average strength, had become so fickle, that he was obliged to carry a note-book, in which to record his most trivial routine engagements. He also suffered from soreness in the back and occasional attacks of facial neuralgia.

On examination his muscular system was found to be weak and flabby, his heart's action feeble and irregular and his general condition one of pronounced anæmia. Pressure along the spinal column revealed two points of marked soreness, the one in the dorsal, the other at the level of the second lumbar vertebræ. From the first of these tender spots radiated, especially on sudden changes in temperature, intercostal pains of considerable intensity.

Having placed the patient on a tonic regimen and prescribed the iodide and bromide of potash, the latter to be taken in cumulative doses during the afternoon and evening, I directed my attention to the points of tenderness in the spine. Instead of treating them by the long and tedious method of local galvanization, I decided to try the efficacy of local injections of a cocaine solution of low percentage (1%). I had already somewhat developed this mode of treatment by experiments on animals (dogs and rabbits), and on one occasion I had already made use of it in the case of a man suffering from spinal irritation. The injections were made with an ordinary hypodermic syringe and needle, thirty minims of a 1% solution of the hydrochlorate of cocaine being deposited in the painful zone. Owing to the possible danger of wounding the cord, I did not make these injections as deeply as I desired, for at that time I had not developed the technique of the procedure sufficiently to admit of this. Later, however, I discovered a method of performing this part of the operation in the most perfect manner, without either danger or inconvenience to the patient.[1] This perfected technique has already been thoroughly described in the previous chapter; and its efficacy abun-

[1] See previous chapter. Also "Scientific American Supplement" for Sept. 24th, 1887, and the "Medical Record" for March 17th, 1888.

dantly demonstrated by numerous clinical histories. In spite of the inevitably primitive nature of the procedure, I succeeded in affording much relief to the patient; so that, after the injections had been repeated a few times, the soreness disappeared entirely.

When I compare the promptness of the relief obtained in this case with the long course of palliative treatment required in the case detailed at the beginning of this chapter, I am the more surprised that greater efforts have not heretofore been made to affect the functions of the cord by resort to more effective and direct methods.

Having thus detailed some of the painful complications often encountered in even the milder phases of concussion of the spine, it now becomes necessary to leave this interesting portion of the subject; for, it is self-evident that to pursue the matter further would be to transcend the natural limitations of a dissertation of this sort.

As to the subject of local medication in its truest sense, that is the bringing of medicinal substances into the immediate vicinity of or in direct contact with the cord, in contradistinction to measures applied at a distance from the latter, as upon the integument, I can only say that judged by results, the improved procedure is inevitably destined to play a conspicuous part in the neuro-therapeutics of the future.

PART V.

Normal and Morbid Sleep.

CHAPTER XXVIII.

CONSIDERATIONS ON THE PHYSIOLOGY OF SLEEP.

I HAVE already had occasion to allude repeatedly, in different portions of this work, to the important part which derangements of sleep play in intra and extra-cranial head-aches, and indeed in all forms of pain. Mention has also been made of the great benefits to be derived from the skillful use of prolonged sleep, in the treatment of all varieties of head-pain.

A proper understanding of sleep is, therefore, quite as necessary to the physician who would treat those painful affections properly as to the alienist engaged in the management of mental disorders. The concluding portion of this treatise will, therefore, be devoted to the consideration of the more important phases of normal and morbid sleep.

As a preliminary to the consideration of the more intricate questions, a discussion of the physiological factors involved will prove useful.

Sleep may be defined in general terms as that state of the central nervous system in which the higher centres are, to a great extent, in a condition of physiological quiescence, with all the consequences thereby implied. In its most profound form, and probably in it most perfect manifestation, there is a total cessation of the strictly psychical functions. The automatic and reflex centres, on the contrary, are active, so that the functions dependent thereon—such as respiration, circulation, digestion, secretion, etc.—are regularly car-

ried on. Again, the re-actions to external excitation must be considered as systematized reflex actions, as they are in every respect similar to the automatism observed in decapitated animals. Judged from an experimental standpoint there is indeed no reason why these phenomena should not occur even with a certain degree of apparent objectiveness, without necessitating the intervention of the strictly psychical centres.

During the early history of medicine everything pertaining to sleep was regarded with more or less superstition, and the theories propounded respecting the nature of the same were as a rule of the most fantastic nature. It is, indeed, only within comparatively recent years that experimental physiology has essayed the solution of a problem, which even to investigators of ripe understanding seemed little short of hopeless. The difficulties with which the subject is inevitably environed are certainly great, and scientific progress has of necessity been slow, in spite of the efforts of even the most original minds. At the present day, however, a survey of the investigations which have been made in this department of phsyco-physiology cannot fail to cause gratification at the substantial and durable nature of the acquisitions. Among the most important experimental contributions to the physiology of sleep are those which have served to exhibit the relation of the intra-cranial blood-stream to the cerebral protoplasm.

There can be no doubt that the ancients entertained certain theories respecting the relation of the carotid circulation to the function of sleep. Thus, in an interesting paper, Pilz[1] refers as follows to the knowledge pos-

[1] "Zur Ligatur der Arteria Carotis Communis," von Dr. C. Pilz, Langenbeck's Archives für Klinischie Chirurgie, vol. IX., p. 406. 1868.

sessed by Rufus of Ephesus respecting the influence exercised by digital compression of the carotids upon the function of sleep. "Arterias per collum subentes carotides, id est somniferas, antiquos nominesse, quoniam compressæ hominem sopore gravabant."[1] These early accounts of compression are, however, enveloped in a veil of uncertainty; and whatever use the ancients may have made of the procedure seems to have been speedily forgotten by subsequent writers. At all events, comparatively little is to be found in literature upon the subject until the close of the eighteenth century, when Parry, of Bath (1792), again directed the attention of the profession to the efficacy of digital compression of the carotids, as a means for the alleviation of convulsive disorders. The publication of this paper seems to have added a new impetus to the subject; and the result is a series of papers, extending over a period of seventy-five years. In 1819 Dr. M. Bland published some interesting cases, illustrative of the efficacy of digital compression of the carotids in cerebral disorders characterized by engorgement.

Twenty years later Dr. J. B Stroehlin[2] published an article upon the same subject. In an article published in 1841, Dr. Troudeau[3] calls attention to the great efficacy of digital compression of the carotids in convulsive disorders. A case of acute meningitis is cited, in which the author essayed digital compression of the carotids with good results.

Reference is also made to the discussion respecting the priority of the discovery of digital compression, which ensued upon the publication of MM. Trousseau's, Baudelocque's, and Malapert's papers. In the

[1] Morgagni, de sedibus et caus. Morb. epist. 19, quoted by Pilz.

[2] "Medical Examiner," April, 1841.

[3] "Journal Medico-Chirurgical" of November, 1840.

paper of Dr. Dezeimeris, which appeared about the same time, the credit of the discovery of the therapeutic value of digital compression is awarded to Parry, of Bath. In 1848 Waller[1] published an essay on the uses of digital compression, in which, while praising the procedure in the highest terms, he expresses regret that the difficulty often experienced, in adapting the fingers to the contours of the arteries, should be so great.

Seven years after the publication of the paper of Waller, Fleming[2] instituted some experiments, with a view to ascertaining the physiological effects of compression. By exercising pressure with the fingers upon the carotids this observer was able to produce sleep on several occasions.

During the same year Dr. T. W. McArthur[3] published a paper upon the therapeutic effects of the procedure, in which he expresses the conviction that compression of the carotids is beneficial in at least some convulsive diseases.

In 1860 Durham[4] ascertained by direct observation that the amount of blood circulating in the brain is reduced in quantity during sleep. His experiments were performed in the following manner: A circular opening was made in the skull of a dog with a trephine, care being exercised not to cause injury to the membranes. A portion of the dura was then carefully removed, so as to expose the vessels of the pia mater and a watch-glass cemented over the opening.

[1] "Medical Counsellor," September, 1855.

[2] An article by Dr. Alexander Fleming, "British and Foreign Medico-Chirurgical Review," April, 1855.

[3] "On Compression of the Carotids—Its Effects on Headache, etc.," by Augustus Waller, M.D., "Journal of Psychological Medicine." London, 1848.

[4] "The Physiology of Sleep," by Arthur L. Durham. "Guy's Hospital Reports," vol. vi., 1860.

When the animal was awake the vessels of the pia were observed to be moderately distended, whereas during sleep the brain was somewhat retracted and presented a pale appearance.

The contrast in the appearance of the organ during activity and repose is said to have been remarkable.

This paper belongs in the category of the most important contributions to the physiology of cerebration. The author's critical interpretation of the phenomena is masterly and is well worthy of careful perusal. This is not the place, however, to enter into an analysis of the inferential data of the paper. Five years after the publication of the experiments of Durham, Dr. Guibert[1] gave expression to his views regarding the value of digital compression of the carotids as a therapeutic agent, noting with regret the evident neglect which this valuable procedure had met with at the hands of the profession.

In 1869 Hammond[2] published the results of a series of experiments, undertaken with a view to ascertaining the amount of cerebral pressure present during sleep, as well as during wakfulness. The experiments were performed upon dogs and rabbits, by the aid of an instrument called the "cephalohæmometer," invented by the author. This appliance "consists of a brass tube, which is screwed into a round hole made in the skull with a trephine. . . . . Both ends of the tube are open; but into the upper is screwed another brass tube, the lower end of which is closed by a piece of very thin sheet india-rubber, and the upper end with a brass cap, into which is fastened a glass tube.

[1] "De La Ligature et de la Compression des Artires Carotides," "Union Medicale," January, 1865.

[2] "New York Medical Gazette and Quarterly Journal of Psychological Medicine and Medical Jurisprudence," January, 1869.

. . . The inner arrangement contains colored water, and to the glass tube a scale is affixed. . . . This second glass tube is screwed into the first, till the thin rubber presses upon the dura mater, and the level of the colored water stands at 0, which is in the middle of the scale." It was found that when the animal is asleep, the liquid falls in the tube, indicating that a diminution in cerebral pressure has taken place. Now, since the pressure is in direct proportion to the quantity of blood circulating in the brain, diminution of the former can only take place in consequence of a reduction in the amount of intra-cranial blood. When the animal awakes the liquid in the tube is seen to rise at once. Thus, by virtue of the results obtained by Hammond, the experiments of Fleming and Durham receive substantial confirmation.

Schiff[1] has found by *direct* measurements performed upon the brain, that a local development of heat takes place in the particular district where an impression is disseminated. And he has furthermore ascertained that this local development of heat is a dynamic phenomenon, *quite distinct from any mere activity on the part of the circulation.* We have in a word to do with an evolution of heat in the psychical centres which takes place on the advent of the sensorial impression. The direct and indirect value of these investigations of Schiff to psycho-physiology it is difficult to overestimate.

Lombard and others have shown that during active mentalization the temperature above the skull rises. The thermo-electric instrument employed by Lombard in these investigations is extremely ingenious; a description of the same is contained in the "British Med. Journal," 1875.

[1] "Archives de Physiologie," 1870.

Several years ago, while yet entirely ignorant of the experimental researches of Fleming and Durham, I was led by considerations of a purely theoretical nature to inaugurate a series of experiments with the object of determining the effects produced by pressure applied to the stems of both carotids. My first attempts at compression were made with the fingers; but I soon became aware of the inherent defects of this method. Ere long, however, the thought suggested itself to me that an instrument might be devised which would effectually obviate the disadvantages of the digital method.[1] Accordingly after many trials I succeeded in constructing an appliance with which I was not only able to conduct some highly instructive experiments, but likewise to add a chapter to the therapeutics of epilepsy, acute mania, and certain functional cerebral disorders, characterized by vascular derangements. Without entering into the details of these investigations, which have long since received extensive recognition both in this country and abroad, I will briefly summarize the more important physiological phenomena which they served to exhibit. When pressure was made upon both carotids with the instrument above referred to, the first symptom which attracted my attention was marked facial pallor. As the degree of compression was gradually increased there was marked drooping of the eyelids, accompanied by dizziness. These symptoms were soon followed by retardation of respiration and cardiac action, while at

[1] For a description of this instrument and for an account of the experiments performed with it see "Medical Record" of February 18th, 1882. Also, "Carotid Compression," by J. Leonard Corning, M.D.; Anson D. F. Randolph & Co., New York, 1882. Finally: "Electrization of the Sympathetic and Pneumogastric Nerves and Carotid Compression." Ibid. "New York Med. Jour.," Feb. 22d, 1888.

the same time, in a considerable proportion of cases, the subjects complained of a heavy, drowsy sensation. So overpowering was this soporific tendency in some subjects that a condition closely simulating if not actually equivalent to sleep was produced. In very anæmic persons it was possible to produce an instantaneous condition of syncope; while in several cases of acute congestive mania I was enabled to produce a condition which, as far as I was able to ascertain, was identical with natural sleep. With the idea of eliminating all sources of error which might be conceived as arising from contiguous nerve-stems, I had constructed a large cylindrical apparatus, by means of which it was possible to enclose the lower extremities hermetically. An air-pump, attached to the apparatus by means of a rubber hose, enabled the experimenter to exhaust the cylinder to any desired degree. With this apparatus, I was enabled to produce retardation of respiration, and cardiac action, as well as marked soporific phenomena in some cases.[1]

Finally, the experiments of Nounyma and J. Schrieber[2] have shown that, when the amount of intra-cranial blood is increased, there is a corresponding diminution in the quantity of cerebro-spinal fluid within the skull,

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[1] For an account of these and other investigations *vide* "Medical Record," Feb. 18th, 1882; an article on "Sleep," "Medical Record," July, 1882. A monograph on "Carotid Compression," Anson D. F. Randolph & Co., New York, 1882. A paper read before the New York Neurological Society June 6th, 1882, and published in the "Philadelphia News" of June 17th, 1882, and in the "American Journal of Neurology and Psychiatry, 1882. Also a paper on "Electrization of the Sympathetic and Pneumogastric Nerves," with Simultaneous Bilateral Compression of the Carotids, "New York Medical Journal," Feb. 23, 1884.

[2] Über Gehirndruch von Nounyma and J. Schreiber, Leipzig: F. C. W. Vogel, 1881.

owing to a deviation of the liquid in the direction of the spinal subarachnoid space.

These experiments prove beyond question that the degree of sanguineous irrigation of the encephalon is in direct proportion to the amount of functional activity of the organ. When the activity of the brain is greatest, the hyperæmia of the meninges obtains a maximum degree of intensity; whereas, during the functional quiescence of sleep, the amount of blood circulating in the vessels of the pia mater is at a minimum. That this relation of the blood-stream to the cerebral plasma is not one of mere concomitance, but rather the outgrowth of the functional necessities of the cerebral cell itself, is proven by the immediate diminution in the intensity of brain function, which ensues upon compression of the carotids. Even where the protoplasm of the ganglia is in an unstable condition, as in epilepsy, it is possible, as proven by the experimental observations of Stroehlin, Trudeau, Waller, McArthur and myself, to arrest the convulsions to which the unusually explosive condition of the cerebral parenchyma gives rise, by pressure upon the stems of the common carotid arteries.

The ebb and flow of the intra-cranial blood-stream, then, is contingent upon the functional necessities of the ganglia. Cerebration is essentially a process of oxydation. Inversely, sleep is that condition in which oxydation within the ganglia is at a minimum. The unconsciousness, which is the characteristic feature of sleep is, therefore, nothing more than the expression of a decline in the processes of metamorphosis within the brain cell. The local cerebral anæmia, the retarded heart beat, and the infrequent respiration are at once the direct consequent of, and

indispensable requisite to, the decline of cerebral metamorphosis.

As to the more intimate nature of the metamorphosis incident to cerebration, but little is known with certainty. Hammond [1] has conducted a series of careful urinal analyses, for the purpose of ascertaining the changes in the composition of the urine incident to increased mentalization. From these experiments he is led to draw the following conclusions:

(1.) That increased mental exertion augments the quantity of urine.

(2.) That, by its influence, the urea, chlorine, and phosphoric and sulphuric acids are increased in quantity.

(3.) That the uric acid, on the contrary, is very materially reduced in amount.

(4.) That diminished intellectual exertion produces effects directly contrary to all the above.

More recently, Byasson [2] has demonstrated that the activity of the ganglia is accompanied by an expenditure of phosphorized material, and, furthermore, that this waste product of brain activity is eliminated from the organism through the urine, in the form of phosphates and sulphates. In addition this observer found that the amount of phosphates and sulphates secreted stands in a certain ratio to the quantity of mental energy expended; and that, in a word, the above waste products could be utilized as a measure of the amount of brain work accomplished in a given length of time.[3]

[1] "Urological Contributions," "The American Journal of the Medical Sciences," April, 1856.

[2] "Journ. d'anat. de Robin," 1869.

[3] For a more detailed account of these experiments than is admissible in a work of this character, see my monograph on "Brain Exhaustion," D. Appleton & Co., New York.

Dr. Robert J. Edes has very recently published a series of experiments by which it is sought to prove "that the amount of phosphates derived from the metamorphosis of brain-tissue in the condition of physiological activity is so small, in comparison with that from the system generally, that it has no perceptible effect on the total of phosphates found in the urine."

Owing to the lack of system observed in these experiments with regard to diet, physical exercise and sleeping, it is impossible to accept the results obtained as either confirmatory of or opposed to the researches of Byasson and others. Until, therefore, more substantial scientific evidence to the contrary is forthcoming, we must accept the conclusions arrived at by these gentlemen. A more extended criticism of these experiments has been given in my monograph on cerebral exhaustion, previously referred to, and I shall therefore abstain from pursuing the discussion further on the present occasion.

If, then, it be admitted, that the greater the expenditure of cerebral force the greater is the excretion of phosphates and sulphates, we are bound to assume conversely that the quantity of these products decreases proportionately with a decline in mentalization. Since, therefore, sleep is the expression of a minimum of cerebration, it follows, as a natural consequence, that during its continuance, the excretion of phosphates and sulphates must be smaller in amount than under any other circumstances.

It is true, nevertheless, that if dreaming and unconscious cerebration be accepted as accompaniments of normal sleep, the integrity of the above argument is vitiated to a certain extent; for doubtless both dreaming and unconscious cerebration represent the output of no little energy on the part of the cerebrum.

Hence the great lassitude observable after sleeping in those who are addicted to excessive dreaming, nightmare or unconscious cerebration. For my own part, I cannot consider any one of these last-named phenomena as constituting an accompaniment of the normal type of sleep strictly considered. As above intimated, nothing is more certain than that those who suffer from nightmare, persistent dreaming and unconscious cerebration awake from sleep far less refreshed than those who suffer from none of these psychological encumbrances. I could cite many cases occurring in my own experience illustrative of this fact. A common complaint on the part of such individuals is that although they have slept a sufficient number of hours, they nevertheless experience no benefit, and awake totally unrefreshed, and entirely unprepared for the activities of the day. Dreaming, unconscious cerebration, and nightmare, will therefore be considered, in the following discussion, among the obvious, though less serious anomalies of sleep. To sum up the evidence, already adduced, we find that the essential factors of sleep are:

1. Exhaustion of the available energy of the cerebral cell, by which it is to be understood that the explosive material, hoarded up during a former period of unconciousness, has become oxydized, and is no longer in a condition to support the chemical process incident to function. As a consequence we have a decline of all the intellectual processes, and finally complete loss of consciousness, accompanied by a fall in temperature.[1]

[1] As shown by Shiff, the rise in temperature, which accompanies intellection, is not alone attributable to the local hyperæmia, but must be ascribed in part, at least, to the increased metamorphosis which takes place within the cell itself. Inversely, it is evident, that the fall in local temperature, observable during sleep, is not

2. Retrocession of the intra-cranial blood-stream, resulting in more or less pronounced anæmia of the ganglia.

3. Decline of oxydation within the ganglia.

4. Retardation of the heart's action.

5. Decline in the rapidity of respiration.

6. Concomitant with the decline of oxydation a gradual re-accumulation of explosive material takes place within the ganglia.

From a consideration of the foregoing physiological factors, it will be seen that during sleep the processes of integration predominate over those of disintegration; whereas during waking the opposite condition prevails. The most important function of sleep then is to counteract the ganglionic waste incident to cerebration.

A thorough comprehension of the physiological significance of sleep is absolutely indispensable alike to the rational understanding and treatment of all forms of mental derangement. Moreover, the various phases of insomnia are only amenable to rational treatment, by virtue of a correct appreciation of the various physiological factors of normal sleep.

CLASSIFICATION OF INSOMNIA.

The following division of insomnia into two principal groups is justifiable, at least from a clinical standpoint. Moreover, while fulfilling the exigencies of practice it will be found to be in essential harmony with the physio-pathology involved. Insomnia may be divided, then, into an idiopathic and into a symptomatic variety. Idiopathic (primary) insomnia is

alone a consequence of the anæmia, but must be ascribed in part to a decline in the intensity of the dynamic processes within the cells themselves.

that form of sleeplessness, the predisposing cause of which cannot be traced to any particular source extraneous to the brain itself. Symptomatic (secondary) insomnia is that form of the disorder which may be observed in the course of many acute and chronic disorders. Under this head may also be considered that form of the affection which arises from a more or less severe degree of pain.

CHAPTER XXIX.

IDIOPATHIC INSOMNIA.

Etiology.—The most important causes of this pre-eminently important variety of the affection are excessive emotional disturbances combined with overtaxation of the intellectual faculties.

Among the former are profound sorrow, jealousy, fear, heavy responsibility, disappointed ambition, suspense, sudden pecuniary losses, and in short every factor which acts with sudden intensity upon the centres of ideation and emotion.

There is probably no single cause so liable to result, if unchecked, in permanent impairment of the cerebral apparatus, as this form of insomnia. It is a fact of the highest theoretic and practical importance, that not only do the lesser forms of functional impairment of the intellectual mechanism begin with some derangement of sleep, but also those graver forms of mental derangement, usually included under the designation of insanity, are almost invariably preceded by more or less chronic insomnia. The wear and tear incident to business and professional competition, as well as the involved nature of the social conditions of modern life have much to do with the prevalence of the disorder. The above proposition is amply substantiated by the statistics of insane asylums and hospitals. In view of these facts it is hardly necessary to insist upon the important relation sustained by disorders of sleep to cerebral economics and pathology.

Symptoms.—These consist in great lassitude during the day, coupled with a high degree of irritability, which is particularly well marked in the morning. The skin has usually a dead, sallow appearance and the eyes are sunken and devoid of their normal lustre. The urine is often scant and highly colored, and a constipated habit is the rule. Sometimes, however, the subject is afflicted by an obstinate diarrhœa, which contributes not a little towards his general enfeeblement. So great is the lassitude in severe cases that the patient reclines upon the sofa the greater part of the day, or wanders about the apartment, unable to summon energy sufficient to perform even the most trivial task. Uncontrollable yawning is present in almost every case. When expostulated with, on account of his listlessness, the subject becomes morose and sullen, refusing in the most peremptory manner to listen to the counsel of those about him. The small ills of life assume commanding proportions, and even the most trivial occurrences are distorted, and magnified to an inordinate degree. On retiring the subject is unable to sleep. He tosses from side to side, removes the bed-clothes, changes his position continually in the vain endeavor to become unconscious. The peripheral irritation occasioned by his contortions only serves to perpetuate the condition of cerebral erethism. When, as frequently happens, sleep at last supervenes, it is no longer physiological in character, but, on the contrary, perverted by dreams and unconscious cerebration to such a degree that it affords little or no refreshment. Daylight finds the individual completely prostrated, and unable to resume his accustomed activities with the requisite amount of energy.

Under these circumstances resort is had to stimulants of all kinds. Strong coffee, tea, brandy and even mor-

phine are tried, with the hope of affording a renewal of vigor. But the relief obtained is at most transitory in character, and the reaction, which inevitably follows, leaves the subject in a far worse condition than before. Where the temperament of the patient is abnormally emotional, the insomnia is of a far graver character than where the cast of mind is essentially intellectual. Adversity, worry and suspense are not well endured by such persons; and even trivial disappointments give rise to all manner of dismal forebodings. The cares of the day, instead of being abandoned at bed-time, take entire possession of the mind, and effectually exclude sleep. It is, moreover, an unfortunate circumstance that the occupations usually preferred by this class of individuals are such as appeal powerfully to the emotions; and thus the mind is kept in a perpetual state of erethism.

On the other hand, those in whom the ratiocinative faculties assume great prominence, though subject at times to attacks of insomnia, are far less liable to become victims of chronic wakefulness than those in whom the emotional faculties are predominant. Moreover, the insomnia peculiar to the former class of persons is not usually accompanied by the extreme mental irritation which is so constant and painful a symptom of the emotional type of sleeplessness.

A vivid imagination is also extremely prone to aggravate an attack of insomnia. The fancy, instead of becoming gradually subdued, until the supervention of unconsciousness, increases in activity; while myriads of fantastic thoughts crowd upon the mind in endless procession, and baffle every attempt at repose. Those possessed of great imaginative powers and strong emotions are particularly dependent upon sleep. Deprived of the latter, they become listless, irritable and

emaciated; and in an incredibly short time the ardor of even the most sanguine dispositions is entirely quenched. During the early part of the night such persons lie awake for several hours, tormented by a constant succession of thoughts and emotions of the most varied character, and not till towards morning do they usually succeed in falling asleep. This sleep, though short in duration, is far from physiological in character, being accompanied in most instances by a succession of morbid dreams, which are the direct outgrowth of the previous condition of mental extravagance.

On awaking, complaint is made of sensations of heaviness, of head pains, which may be variously located, or of a feeling of constriction about the forehead. Sometimes a sensation of distention is noticed in the region of the vertex, which may or may not be accompanied by pain.

There is a large class of persons in cities, employed in hotels, theatres, and other public places of resort, who from the nature of their employment are compelled to remain awake during the whole or a greater portion of the night. It is the habit of these individuals to seek to compensate for the loss of sleep entailed by their various nocturnal employments, by resort to day sleep. Such repose, is, however, both as regards duration and quality, far inferior to the normal sleep enjoyed at night; and the persons who are compelled to resort to it are rarely if ever able to compete in energy or endurance with those whose employments permit them to retire soon after sunset. They become either sallow and emaciated in appearance, or pale and flabby, especially when addicted to the use of alcoholic stimulants. As to the sleep itself, not only is it deficient, as we have seen, in ultimate restorative

effect, but also with regard to quality. Morbid dreams, unconscious cerebration, and nightmare are the usual accompaniments of day sleep. In the majority of cases, persons whose only alternative was the form of sleep just described, have been obliged, after the lapse of but a few years or even months, to desist from the nocturnal employment and adopt some other form of occupation.

CHAPTER XXX.

SECONDARY INSOMNIA.

SLEEPLESSNESS ARISING FROM IRRITATION OF THE CENTRIPETAL NERVES.

In order to insure the most perfect form of natural sleep, there should be, as far as possible, an absence of sensory impressions. When there exist neither irritating disorders within the body nor upon its surface, and when no impressions are transmitted through the special senses, it is evident that the requirements of the above proposition are fulfilled. During normal sleep, it is true, the receptive centres are blunted because of the exhausting effects of the previous stage of activity. As a consequence, moderate sensory impressions, which during the waking condition would have led to active perception, leave no imprint upon the exhausted protoplasm. When, however, impressions of considerable intensity are transmitted to the exhausted receptive centres, the latter become irritated and aroused from the lethargy consequent upon exhaustion, and finally the entire cerebral mechanism is aroused—the individual is awakened.

This is the essental morbid physiology of what I have considered under the head of secondary or symptomatic insomnia.

Dr. Robert J. Graves[1] has given an excellent de-

[1] Clinical Lectures, by Dr. Robert J. Graves, second American Edition: Ed. Barrington & Geo. D. Howell, Philadelphia, 1842.

scription of the insomnia produced by the application of blisters. Such cases are practically experimental corroboration of the views advanced by myself with regard to the nature of symptomatic insomnia. Moreover, they serve to illustrate the anti-soporific effects produced by irritation of the peripheral organs of centripetal nerves. In speaking upon this subject, Dr. Graves observes:—"The bad effects on the nervous system occasionally produced by the application of blisters, are somewhat analogous to those which result from wounds and other external injuries, and to be accounted for on the same principle. . . . Wounds and injuries sometimes make an impression on the nervous system by no means proportioned to the importance of the injured organ to life, or to the extent of the mischief. . . . An injury produced by a body which strikes the sentient extremities of the nerves with great force will sometimes produce very remarkable effects on the system. . . . Thus a musket ball striking a limb may, without wounding any great artery or nerve, or destroying any part of importance to life, produce a train of nervous symptoms of an extraordinary character. The person, without feeling much pain, and scarcely knowing that he has been wounded, without being terrified, or having his imagination excited by an apprehended danger, turns pale, gets a tendency to faint, and sometimes actually dies from the impression made on the nervous system. . . . In the same way an external injury (or even a comparatively slight impression[1]) reacting on the nerves (and centres of perception) may bring on high mental excitement, delirium, and a total privation of sleep. The delirium and sleeplessness arising from blisters is by no means an uncommon disease."

[1] The parenthetical remarks are mine, J. L. C.

The majority of cases of secondary insomnia are traceable to some irritative process affecting the terminal organs of the centripetal nerves, or to some acute or chronic form of organic disease, by which a vast number of sensory nerves are kept in a more or less continuous state of irritation.

If the pathological physiology advanced by myself be accepted, it will readily be understood why acute and chronic affections should produce obstinate sleeplessness, even where no considerable degree of pain is present. Furthermore, the views expressed by Dr. Graves concur with mine in every particular.

Among the diseases which most frequently produce insomnia are: Cutaneous affections, acute and chronic pulmonary diseases, neural hyperæsthesia (neuralgia), stomachic disorders, syphilis and fevers. It is sufficiently obvious also that pain, whatever may be its origin, is one of the most prolific sources, if not the most prolific cause of insomnia. Again certain forms of kidney and hepatic troubles may produce more or less protracted wakefulness.

Without pursuing the subject in all its ramifications, which would be a useless loss of time as far as any practical benefit is concerned, it will be well to bestow a glance upon the various forms of morbid dreams, which are so constant an accompaniment in almost all cases of wakefulness.

CHAPTER XXXI.

CONSIDERATIONS ON DREAMS.

The composition of dreams is determined in great measure by the individuality of the subject, and by the sum total of the impressions of which he has been the recipient. As to the contents of a particular dream, it is a matter of common experience that the accidental emotions and ideas, present in the mind previous to retiring, exert a determining influence upon its constitution. All the multifarious factors of the mental life of the individual—all that he has felt, willed, or experienced—may be revived in his dreams.

The impressions which may give rise to dreams by acting upon the individual during sleep are of various kinds. In the first place the impressions which act upon the central ganglia through the five senses very often give rise to dreams.[1] Secondly, the subjective excitation of the senses, as well as muscular sensations and general impressions of the most varied character, may result in the production of dreams. Even where a certain sense is closed to outward impressions, the individual is by no means necessarily deprived of the sensations and ideas arising from the same when in a normal condition. Thus Esquirol[2] mentions the case of a man who when forty-one years of age was afflicted by double cataract, and who nevertheless be-

[1] Vide the opinions entertained by Schopenhauer relative to this point, Parerg. und. Paralipom. Leipzig, 1877.

[2] Cited by Radestock.

came enraged with persons whom he supposed he saw. Biester relates that there lived in Anspach, not many years since, an old midwife entirely blind, who complained that she was troubled not by ghosts, but by the frequent appearance of animals and men. The apparitions were quite as vivid as though she were in full possession of the power of vision.[1]

Malposition of the body, indigestion and other causes which tend to impede the circulation are said by some to give rise to cardiac palpitations, difficulty of respiration, and, when the phenomena are very pronounced, to nightmare. While willing to admit that such may often be the case, I feel compelled to affirm that I have known of many cases of nightmare in which no such factors as malposition of the body in bed or indigestion could be ascertained. Indeed the only possible assignable cause of the disorder was a condition of cerebral irritation or exhaustion. It is my firm belief that precisely as palpitations and difficulty of respiration are produced by excessive emotions during waking, so the same derangements may be caused during sleeping as a result of the excessive emotional disturbances often present during dreams. Where the subject of dreams is of a neurotic temperament or a sufferer from cerebral exhaustion or irritability, the influence of purely psychological disturbances (whether occurring during waking or as accidents of sleep) upon the respiratory, cardiac and general bodily functions, is far greater than in those of more robust constitution. Among ancient and mediæval peoples the frightful phenomena of nightmare were ascribed to some supernatural agency, and demonology and witchcraft have at all times received substantial support from the same frightful source. The inhabi-

[1] Berliner Monatsschrift, October, 1800.

tants of New Zealand regard the apparitions of dreams as hurtful deities, and similar opinions are entertained by some of the tribes of Central America and by some of the inhabitants of the coast of Africa.

So excellent an authority as Augustin believes that the visits of the incubi have been attested by so many competent witnesses, that a further denial of the fact is impossible.

The following narrative, recorded by Raoul Glaber, embodies such a graphic illustration of nightmare, that I give it in full, in lieu of further description: "One night towards early morning, I saw, sitting at the foot of my bed a little monster of hardly human shape. It appeared to me to be of medium size, thin necked, emaciated form, with black eyes and a narrow wrinkled forehead. The nose was broad, the mouth large, the lips thick, and the chin short and sharp. A goat's beard, straight pointed ears, dirty dry hair, dog's teeth, pointed occiput, projecting breast, hump back, withered loins, and dirty clothes completed the picture. It seized the side of my bed, shook it with fearful strength, and said: Thou shalt not remain here long. Upon that I awoke terribly frightened, sprang out of my bed, ran to the cloister, and cast myself before the altar, where I remained for a long time petrified with fright."[1] Guibert de Noigent relates: "One night I was awakened by difficulty of breathing; I believe it was winter. I lay in my bed and considered myself safe in the glow of a brightly burning lamp. Suddenly the deep stillness seemed to be broken by a myriad of voices proceeding from above. At the same time my head seemed to be wrapped, as it were, in a dream; I lost the use of my senses and thought I saw a certain dead person appear before me, and a

[1] Op. cit., p. 127.

loud voice declared that he had been murdered in his bath. Frightened by this apparition, I sprang from my resting place with a loud cry, the lamp was extinguished, and in the midst of the horrible darkness I saw the demon in his true form standing by the bed."

In our own day the substance of dreams is somewhat less demoniacal in character; and witches, devils and hags have given place to the denizens of the jungle and the forest. Tigers, boa-constrictors, scorpions, centipedes, all the fear-inspiring shapes which adorn the pages of a hideous zoology, are the companions of the modern dreamer. But the repertory of dismal shapes is by no means confined to natural history. Theology, history, romantic literature, love and hate, all afford material for dreams. Sometimes those afflicted with nightmare experience a sensation as though the chest were bound down with chains, or as though a huge stone were rolled upon the breast. All such sensations are the outgrowth of the disturbances of respiration to which reference has already been made. Since nightmare usually occurs shortly after midnight, Prout is led to the conclusion, that the cause of this form of dreaming is to be ascribed to the condition of the blood, which at that time according to his observations is saturated with carbonic acid to a maximum degree. Macnish found that he was attacked by nightmare when he sat in an arm-chair or when his head reclined upon the table, or even when lying upon his side.[1] Such a position as the one first described is well calculated to cause interference with the freedom of the inspiratory act; and thus an undue accumulation of carbonic acid in the blood is the inevitable

[1] Der Schlaf in Allen seinen Gestalten, (translated from the English) Leipzig, 1835.

result. J. Börner[1] has shown experimentally, that interference with the ingress and egress of air to and from the air passages may result in the production of the phenomena of nightmare. In order to prove this he fastened the bedclothes over the mouth and nose of a person in deep slumber, so that respiration was partially interrupted. Upon this it was observed that the face of the sleeper became suffused and his respiration retarded; while the respiratory muscles were thrown into violent action and the veins of the neck became greatly swollen. After awaking the person experimented upon related that he had suffered from the symptoms of nightmare, the apparition appearing in the form of an ugly monster. Severe catarrhal affections, when coupled with a somewhat heavy evening meal, may give rise to difficulty of respiration and morbid dreams, if we are to accept the testimony of Binz.[2]

But dreams are by no means always characterized by the pressure of the terrible or hateful. On the contrary they present not only the shadows, but also the brightest side of real and imaginary existence. Only in dreams do the majority of mankind ever succeed in realizing their most fondly cherished wishes, their highest ideals. Many a talent, many a genius condemned by the relentless circumstance of environment from adequate expression, has found in dreams a temporary emancipation from the thraldom of reality. Riches, power, perfect health, achievement, are all possible in dreams, and only thus are the majority of mankind ever to know them. If dreams were invariably the outgrowth of impressions and ideas originating in

[1] Das Alpdrücken, seine Begründung und Verhütung-Würzburg, 1855.

[2] Cited by Rhadestock, Op. cit., p.130.

the occupations of the previous day, then, indeed our nocturnal reveries would be far from agreeable. The circumstances, however, are fortunately very different. It is a matter of experience, in fact, that dreams are often built up of remote ideas, the very remembrance of which has long since faded from memory. The resuscitation of these dim ideas from the lower strata of consciousness, as a consequence of central stimulation, is certainly one of the marvels of psychology. Moreover, owing to a further automatic excitation, the reproduced ideas are interwoven with other revived impressions, so that the dream receives the most variegated coloring.

CHAPTER XXXII.

THE DIFFERENCE BETWEEN DREAMS AND WAKING THOUGHT.

From what has already been said with regard to the constitution of dreams, it will be seen that a scientific classification of the phenomena is beset with unusual difficulty. So manifold, and, at the same time, so devoid of all sequence and coherence are the manifestations of dreams, that the comparison of the latter with insanity seems in a certain sense justifiable.

Pfaff, Krauss, Artemidoros, Purkinje, Spitta and Nicol have sought to classify the phenomena of dreams; but, with the exception of the subdivisions of Spitta, these systems possess little practical value.

The most rational method of approaching the subject is that which is based upon a consideration of the elements of dreams, and the laws governing the association of ideas.

A glance at the composition of dreams reveals the fact that the distinguishing feature of individual conceptions is their great exaggeration and vividness, which is doubtless attributable to the inordinate excitability of the higher centres. Comparatively insignificant impressions transmitted through the centripetal nerves are sufficient to arouse a series of the most exaggerated conceptions. The crackling of a dry floor becomes the tramp of the assassin, the moonbeams falling upon the eyelids are magnified to the dignity of a conflagration; while the rustling of leaves or the

gentle sighing of the wind becomes the roaring of a tornado. An insignificant irritation, such as the bite of a mosquito, gives rise to a positive sensation of pain, and a slight tickling sensation in the throat causes a feeling of suffocation.

It is a noteworthy circumstance, and one difficult of explanation, that the exaggerated conceptions and emotions of dreams are far less liable to result in serious detriment to the organism than the corresponding perturbations of the waking condition. Thus sudden and violent grief during waking has frequently resulted in immediate death; and even unexpected emotions of intense pleasure have been known to result fatally. A soldier returning from the battle-field is suddenly apprised of the death of his mother; and although inured to the hardships and terrors of the campaign, is unable to withstand the effects of the sudden mental contest, and falls dead, as though smitten by one of his own bullets. A poor laborer, accustomed to severe toil, is informed that a relative, of whose very existence he was perhaps unaware, has died and bequeathed to him a competency, which will render him independent for the remainder of his days. Instead of manifesting joy he becomes insane or dies. The examples are legion. Rarely, however, are similar effects witnessed even after the most severe attacks of nightmare.

Although we are unable, by a mere fiat of the will, to cause a cessation of our conceptions, we are yet able to control, within certain limits, the direction of our thoughts. What is possible in the waking condition, however, becomes impossible for the erratic cerebration of sleep. The conceptions arising during dreams admit of no guidance; the only governing influence being the law of the mutual relation of ideas. As a

matter of fact, however, the impressions received before retiring, as well as the focalization of the thoughts in a certain direction for a protracted period of time generally have a marked influence upon the composition of the dreams of the individual.

Thus the financier whose mind has long been occupied with apprehensive speculations, will naturally dream of accounts, dollars and cents, and compound interest; whereas the captain of a ship is more liable to be troubled by nocturnal visions of sea-serpents and shipwreck. It will thus be seen that, although we can exercise no volitional effect upon the composition of our dreams, in the sense that we give direction to our waking thoughts; we may, nevertheless, by throwing the energies of the mind in a given direction, before retiring exert a predetermining influence upon the character of our nocturnal reveries.

I have been thus explicit, as the subject is an important one from a therapeutic standpoint.

The rapid evolution of conceptions during dreams is favorable to the development of new psychological combinations. This fact explains the frequent, but, at first sight, inexplicable circumstance of a high order of rhythmical intellection occurring during dreams. Poems, musical compositions, and philosophic epigrams have been compared, and even complicated inventions conceived during dreams. As a rule, however, these nocturnal achievements cannot stand the test of daylight; and even the most superficial logic serves to reveal their extravagance and worthlessness. The capacity for forming correct inferences and judgments is, in fact, greatly reduced during dreams, owing to the volatile nature of the conceptions.

The feeling of personality, the "I," is the result of

a summation of all the psychical activities, feelings, volitional activity, etc. In the construction of the "I" two factors are principally concerned. First, the permanent conceptions formed by ourselves, and which are the outgrowth of our motor and "general" sensations, and of the memories (and their associations) resulting from the repetition of external impressions. Secondly, the attention or active apperception. Now, since in dreams the last named factor of the "I" assumes a passive form, the reunion of various groups of conceptions under one uniform head is interfered with, by reason of the chaotic perception and remembrance of fragmentary portions of the former (the conceptions).[1] As a consequence of the diminished attention, then, the feeling of individuality, the sensation of the "I," which is so characteristic a feature of the waking condition, is in dreams reduced to the last degree.

The foregoing are the more important points of difference between the psychology of dreams and that of the waking condition.

If, in treating the subject somewhat in *extenso*, I have rendered myself liable to the charge of undue prolixity, I can only plead in extenuation the great importance of the subject to a true understanding of both the pathology and therapeutics of sleep.

It is precisely pain, in its various manifestations, which serves quite as much as psychical difficulties to cause derangements of sleep. To deal successfully, therefore, with these painful conditions, one must have a thorough understanding of sleep and its derangements.

[1] Rhadestock, Op. cit., p. 157.

CHAPTER XXXIII.

MORBID SOMNOLENCE.

In the previous portion of this discussion we have described at some length the various conditions which tend to reduce the amount of sleep normally required by the organism. It now remains to consider briefly that condition in which the duration of the sleeping period is abnormally increased.

Any one who has paid special attention to the matter, will be able to recall the cases of individuals who, by reason of long sleeping or on account of a general drowsy habit, have become known to their acquaintances as lazy, thriftless members of society. And yet, such persons are frequently far more deserving of compassion than of censure; for a closer insight reveals the fact that their inactivity is neither the result of defective ambition nor feeble volition, but is rather the outgrowth of morbid physiological conditions wholly beyond their control.

Here is an illustration in point: A lady, for whose intelligence and Christian character I entertain the highest respect, consulted me some time since with regard to her husband, a man who, up to within a comparatively recent period, had been exceptionally active in business. Of late, however, he had become "absent" in manner, and had besides developed habits of extraordinary lethargy. In former times he was in the habit of retiring about eleven o'clock; now he sought his bed at nine, where he remained until

eleven or twelve o'clock the next morning. Instead of exhibiting his former vivacity, he remained during this brief period of wakefulness, if wakefulness it could be called, in a condition of apathy, like one overcome with fatigue and about to fall asleep at any moment.

Such conditions as this are doubtless familiar to most physicians who have devoted special attention to the physiological questions pertaining to sleep.

The following classical cases, reported by Robert Macnish, are extreme illustrations of morbid somnolence:

"The case of Elizabeth Perkins is remarkable. In the year 1788, she fell into a profound slumber, from which nothing could arouse her, and remained in this state for between eleven and twelve days, when she awoke of her own accord, to the great joy of her relatives, and wonder of the neighborhood. On recovering she went about her usual business; but this was only for a short period, for in a week after she relapsed again into a sleep which lasted some days. She continued, with occasional intervals of wakefulness, in a dozing state for several months."

"The case of Elizabeth Armitage of Woodhouse, near Leeds, may also be mentioned. The age of this person was sixty-nine years. She had been for several months in a decline, during which she had taken very little sustenance, when she fell into a state of lethargic stupor, on the morning of the 1st of July, 1827, in which condition she remained, without uttering one word, receiving any food, or showing any signs of life, except breathing, which was at times almost imperceptible. In this state she continued for eight days, when she expired without a groan."

One of the most extraordinary instances of excessive

sleep, is that of the lady of Nismes, published in 1777, in the "Memoirs of the Royal Academy of Sciences of Berlin." "Her attacks of sleep took place periodically at sunrise and about noon. The first continued till within a short time of the accession of the second, and the second till between seven and eight in the evening, when she awoke, and continued so till the next sunrise. The most extraordinary fact connected with this case is, that the first attack commenced always at daybreak, whatever might be the season of the year, and the other always immediately after twelve o'clock. During the brief interval of wakefulness, which ensued shortly after noon, she took a little broth, which she had only time to do, when the second attack returned upon her, and kept her asleep till the evening. Her sleep was remarkably profound, and had all the characters of complete insensibility, with the exception of a feeble respiration, and a weak but regular movement of the pulse. The most singular fact connected with her remains to be mentioned. When the disorder had lasted six months, and then ceased, she had an interval of perfect health for the same length of time. When it lasted one year, the subsequent interval was of equal duration. The affection at last wore gradually away; and she lived entirely free of it for many years after. She died in the eighty-first year of her age, of dropsy, a complaint which had no connection with her preceding disorder."

Of the pathology of these strange cases we know nothing; nor can we form an estimate of their causation. The most that we can say is that in certain cases of extreme exhaustion or intoxication (due to renal difficulty, etc.), certain somewhat analogous conditions may be provoked. The comparison is at most, however, but a crude one.

CHAPTER XXXIV.

SOME GENERAL OBSERVATIONS ON THE TREATMENT OF INSOMNIA.

We have already had occasion to refer to the important relations existing between derangements of the function of sleep and mental disorders. But not only has it been shown that sleeplessness is one of the concomitants of insanity; for, we have also seen that it is an important factor of most painful maladies, and particularly of that variety of pain which is traceable either to morbid conditions within the skull or such as are located outside of it.

Facts of this kind point clearly enough to the importance of possessing some knowledge regarding this matter of sleep; indeed it is quite inconceivable that one should be able to do much for the painful affections which we have been considering without such knowledge. I shall, therefore, offer no apology for recording a few of the more important principles underlying the treatment of insomnia.

In the first place, then, when we are confronted with some one of the painful conditions described in previous portions of this work, we should at once make a careful investigation into the habits, bodily condition, and possible hereditary influences of our patient.

If we find that he is a night-worker of long standing, we should attempt to gradually abate the vicious habit; should we find that the patient has formerly

been of a robust habit, and has suddenly or even gradually lost flesh, inquiry should immediately be made as to the existence of some form of excess or wasting disorder, so that we may put a stop to the one and address our skill to the amelioration of the other.

Should, on the other hand, a history of syphilis or scrofula be forthcoming, we shall at once know what we have to do, if we aspire to achieve fundamental results.

There is nothing in these painful conditions more significant than a sudden variation in the weight or circulatory conditions of the patient. For example, we are called to see a young married woman suffering from some form of head-pain. Her complexion is pale and sallow; she complains of sleeping poorly; she has had a miscarriage, or it may be that she has suffered from leucorrhœa or catarrh of the cervix.

In such a case as this there are two conditions which strike us at once—loss of weight and small, compressible pulse. Where this duo exists, more particularly if the subject be of neurotic temperament, we are certain to have an exacerbation of some form of head pain with its baneful accompaniment, sleeplessness.

Take the exactly opposite condition of a man who has gained flesh rapidly. In a considerable proportion of such cases the history of alcoholic excesses, with its accompanying stasis of the cerebral blood stream, is forthcoming. At the same time we learn that the patient is a sufferer from cerebral hyperæmia, with its consequent symptoms of irritability, depression, vertigo, headache and insomnia. Here are two diametrically opposed conditions. In the case of the woman we have general anæmia, with consequent impoverishment of the entire nervous system; in the

man we have engorgement. passive expansion of the cerebral capillaries with consequent turgescence of the cerebral circulation.

To treat these two cases in a similar manner, to pin our faith exclusively to mere sedation by chemicals, would be simply to ignore the appositeness of the physiological circumstances with which we have to deal. And yet, these are precisely the things which are most systematically ignored; indeed one may say, that ninety-nine cases of headache with insomnia are attacked through the medium of the apothecary's shop, without any regard whatever to special hygienic indications.

Under the special headings of anæmic and hyperæmic headache, I have already discussed the means to be resorted to for the relief of the circulatory derangements, which play such an important part in the two affections. All that I then said regarding the applicability of baths, both warm and cold, as well as what was stated regarding the Russian and Turkish baths, applies with equal force to the treatment of the anæmic and hyperæmic varieties of insomnia. To repeat, in detail, what was then said, would be but a repetition of what has already been thoroughly discussed; I would therefore merely observe that the two principles to be borne in mind in the treatment of these cases of insomnia with circulatory disturbances, are first of all to correct the latter by appropriate means, and secondly, while so doing, to address our efforts to calming the irritated cerebral protoplasm. The second part of the problem is best accomplished by the use of chemical substances, which, having an affinity for the cerebral substance, tend by uniting with it to interfere to some extent with that metamorphosis which is essential to function. Such chemical substances are

the so-called narcotics and sedatives, of which more or less has already been said in earlier portions of this work. But, while it would, therefore, be a work of supererogation to enter again into details regarding these substances, I desire to give a general hint or two respecting their employment, in connection with insomnia.

To begin then with the bromides, that group of substances so important in the treatment of nervous affections of a functional character, I would observe that these remedies should be employed with a view to exerting a gradual sedative action upon the central nervous system, so that a predisposition to slumber may be induced. They should therefore be given during the day, and preferably during the latter portion of it, their administration being in fact continued until shortly before the patient betakes himself to bed. A moderate dose of chloral, or the tincture of hyoscyamus, or both combined, as in the preparation known as bromidia, may then be given, so as to materially augment, at the critical moment, the drowsy predisposition.

We have here the key to the secret of obtaining results in the treatment of insomnia, whether the condition be found in conjunction with mental derangement, or whether it be an accompanying complication of a painful affection, or, in short, whatever the predisposing factors may be.

But this is not enough. Were we to rest content with the chemical treatment of sleeplessness, we should be in grievous error; and yet this is precisely what is constantly being advocated in print and in the lecture-room. We must look deeper; we must go to the bottom of the morbid problem, with which we are confronted, so that, having recognized it, we may

combat it with all the resources at our disposal. If we have to do with pain-provoking conditions we must remove them; if we are confronted with inordinate worry we must combat it by the aid of substitution; if, finally, we have to do with some morbid condition of the organs, resident I care not where, it must be met with all the resources at our command. In this connection, what has been said regarding secondary insomnia may be recalled with advantage. Above all things let us eschew inordinate drugging, especially before putting our patient to bed. I have protested against this custom and shall continue to protest against it, as long as I am witness of such flagrant abuses of sedative substances both in and out of asylums.

And again, let us not show undue readiness to lay hold of the resources of the drug-shop; rather let us not forget that, in the ordinary aliments of plain every-day life, much is contained which may prove useful to us. I will merely recall in this connection the hop preparations—those ales, stouts, malt hop toniques and beers of German make, which in themselves constitute an armamentarium somniferum.

Again, let us but direct our attention to the digestive organs; what possibilities are here! So commonly are digestive disorders either the immediate cause, or, at least, the perpetuating factor of these derangements of sleep, that, without a thorough understanding of the stomach in health and disease, we should be quite unable to cope with the secondary consequences, involving the nervous centres.

Of electricity, baths, and cognate adjuncts in treatment, a sufficiently extended mention has already been made in the earlier portions of the work. I shall, therefore, close this discussion of the various questions per-

taining to normal and morbid sleep by observing, once again, that the subject is of the first importance to a correct understanding and management of the painful affections which we have been considering, and more particularly of those pains, located in and about the head, which constitute such prolific sources of human unhappiness.

CHAPTER XXXV.

THE LOCALIZATION OF THE ACTION OF REMEDIES UPON THE BRAIN. — ADMINISTRATION OF CHEMICALS WHICH ACT IN SMALL DOSES, BY THE NOSE; THOSE WHICH MUST BE GIVEN IN LARGER AMOUNTS TO PRODUCE THEIR EFFECTS, BY THE MOUTH.—COMPRESSION OF THE INTERNAL JUGULARS.

In the previous portions of this work, we have devoted considerable space to the consideration of the various theoretical and technical questions pertaining to the local use of remedies in neuralgia. And let me say, that the prominence accorded this portion of the subject is not merely a question of individual predilection, but rather of indisputable expediency, justified as it is by what we know of neuritis as well as by the practical results obtainable in the clinic. Indeed, so apparent are the advantages derivable from the localization of remedies in the treatment of painful affections due to inflammatory or other changes of the peripheral nerves, that I have long desired to extend the principle to the central nervous system, and more especially to the brain. For it will occur to any medical man of average perspicuity that the solution of this problem must render material assistance in the management of various functional difficulties of intracranial origin, not the least of which are certain idiopathic varieties of headache and insomnia. It

may as well be admitted, however, at the very threshold of these reflections, that the concentration of the effects of chemical solutions upon the internal organs is beset with difficulties, insurmountable ones too, in many instances. Thus one reads in the journals from time to time accounts of injections of medicinal fluids into the parenchyma of the lung, or other important viscus, but the thought at once occurs that these fluids can at best produce but evanescent effects upon neighboring morbid products; for they—the fluids—are soon carried away to distant parts of the organism by the circulation; and being thus dissipated, their local remedial effects are proportionately attenuated.

There is, however, one organ which is exceptionally well placed with respect to the possibility of concentrating the action of remedies upon it; I refer to the brain, and more especially to the cortical layers of the cerebrum.

To appreciate how true this is, it is necessary to place in juxtaposition the following facts:

1. That the main blood-supply of the cortex is contingent, or largely contingent, upon the unobstructed flow through the carotid and jugular vessels. Hence, when the blood flow in one or both of these sets of vessels is arrested, or even partially arrested, as by compression, cortical function is directly interfered with, as is shown by the confusion of ideas, stupor, and even unconsciousness engendered.

2. It has long been known—and the fact has frequently been commented upon in medical literature—that chemicals applied, especially in a fluid state, to the lining membrane of the nasal cavity are speedily

absorbed, producing in this way characteristic physiological effects. Thus calomel has been blown into the nose, producing in a short time severe salivation.[1]

Narcotic substances, and more especially morphine and cocaine, have also been spread upon the mucous membrane of the nasal cavity, giving rise in a short time to characteristic phenomena. I am told that the effects thus induced upon the central nervous system, and more especially the brain, by the use of the last-named drug are familiar to rhinologists.

The most reasonable and generally accepted explanation of the prompt action of narcotic substances when used in this way is that which assumes that the absorption of the remedy—or at least the greater part of it—takes place by the way of the vessels which penetrate the lamina cribrosa. If we admit the plausibility of this hypothesis, we shall then perceive that remedies administered by way of the mucous membrane of the nose must reach the brain, and especially the cortex cerebri, in a more concentrated state than when administered at a distance, either hypodermically, per rectum, or by the stomach. Even though the amount of medicinal substance absorbed be not great, its increased concentration at the seat of influence (the brain) must of necessity result in physiological effects out of proportion to the quantity of chemical administered.

Here we have an explanation, and I think a true one, of the remarkable cerebral symptoms often pro-

[1] De l'Administration des Médicaments par l'intermédiaire de la Muqueuse des Fosses nasales; par Rainbert, Journal de Médecine de Chirurgie et de Pharmacologie, Bruxelles, 1867, vol. xlv., p. 17, seventh line from top of page.

duced by exceedingly small quantities of medicinal substances when applied in solution to the eye and conjunctiva.

3. It is a fact that, if narcotic fluids be introduced into the nasal cavity in the manner previously set forth, and if shortly thereafter the flow of blood in the jugular veins be considerably retarded by the application of pressure at a suitable point in the neck, the effects of the remedies thus administered may be appreciably enhanced and prolonged. This accords with all that I have been able to ascertain respecting the behavior of remedies when brought in contact with the peripheral nerves, by hypodermic injection, and maintained there by occlusion of the capillaries, or by constriction of the artery, veins, or both, above the point of injection (next the heart). These preliminary observations will, I trust, make the principles involved abundantly clear to any physician of average intelligence. Let me pass, then, at once, to the description of the simple procedure which I have found most serviceable in giving practical effect to the principles above enunciated.[1] The first step of importance is the introduction of the remedy by way of the nose. To do this most effectually the mucous membrane should first be cleansed with warm water, the latter serving at the same time to expand the capillaries. The medicament (morphine, cocaine, atropine, etc.) may then be introduced in solution through the nostrils by the aid of an ordinary medicine dropper or atomizer. This simple manipulation is best accomplished while the patient reclines upon his back.

After the lapse of ten or fifteen minutes the second

[1] Vide the "Medical Record" of December 31st, 1892.

step may be proceeded with. This consists in materially restricting the lumen of the internal jugular veins by the application of pressure.

After numerous trials, I have found that the jugulars are best compressed by the application of small dry cups over the course of the vessels, one at each

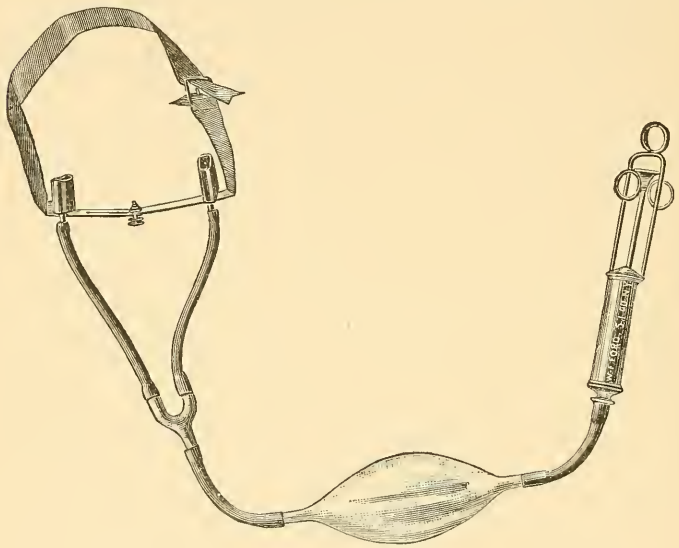

Fig. 16.

side of the neck on a level with—or a little below the level of—the thyroid cartilage.

The cups, which are joined together in front by an adjustable steel band, are about two inches long and half an inch wide; they are made of metal—silver or steel—and are held in place by an elastic strap, which passes around the neck and is secured in place behind by the aid of a simple buckle (Fig. 16). The open side of the cup is, moreover, somewhat concave in an

antero-posterior direction, which admits of elevating the veins and surrounding tissues more effectually. In this way it is possible to draw the vessels into the cups, partially at least, thus causing the edges of the latter to act energetically upon the lumen of the veins. The little dry cups being maintained in position over the vessels by the aid of this simple band, the air contained in them is rapidly exhausted by means of an air-pump and vacuum-chamber, which exert their influence upon the interior of the cups through the intermediation of small, non-collapsable india-rubber tubes (Fig. 17).

It is self-evident that the cohesion of the compressing apparatus thus obtained, as well as the elevation of the tissues within them, render valuable assistance by preventing the slightest displacement of the subjacent vessels. In a word, the veins, instead of being compressed in a backward direction, are, as previously pointed out, drawn toward and compressed by the edges of the cups. When all is properly adjusted, the elastic bands previously described may be tightened at will, thus adding mechanical to atmospheric pressure. This last step is usually, however, unnecessary, the atmospheric pressure being adequate.

When slight vertigo has been induced in this way, the evidence is conclusive that the stasis of the intracranial venous circulation is sufficient for therapeutic purposes.

There is no special limit to the length of time during which compression may be continued; but from what I have been able to determine, I should fancy that from twenty minutes to half or three-quarters of an hour are sufficient.

Illustrative Cases.—The following cases are cited with a view to illustrate the facility and rapidity with which a variety of disagreeable sensations in the head,

Fig. 17.

including minor degrees of pain and depression, are relieved by resort to this simple procedure.

Mr. A. C—— was referred to me over three years

ago by Dr. C. H. Avery, on account of "severe and persistent headache." When I first saw him the headache was diffuse in character, continuous, but not specially severe. He informed me, however, as I find by reference to my case-book, that at times he is afflicted by sudden and very severe exacerbations of pain; and that, at such times, the pain is almost entirely confined to the occipital region. There is very little difference between the pain felt at night and that experienced during the day.

There are no ataxic symptoms; the disks of both eyes are normal, but the pupils are quite uneven, the right one reacting little or not at all to strong light. I sent him to Dr. David Webster for an opinion, who wrote me that there was undoubted "paresis of the right sphincter iridis, without paresis of the ciliary muscle." A high degree of hypermetropia was also present, for which Dr. Webster prescribed the necessary glasses, to be worn constantly. Incidentally he also expressed the belief, in spite of the absence of a specific history, that the mydriasis, and probably also the headache, were due to nervous syphilis.

My own suspicions having taken a like direction, I placed him at once upon large doses of the iodide of potash, which were gradually increased to the point of tolerance.

After several weeks there was appreciable diminution of the pain, so much so that after three months his visits were discontinued. A year or two later I saw him again, and he stated that he was often free from pain for prolonged periods—from several days to three or four weeks.

The paresis of the right sphincter iridis was also

apparently improved, though the contraction of the pupil was quite sluggish.

So far as my case-book reveals, I did not see him again till October 19th, 1892, when he called at my office, complaining of an unusually severe paroxysm, the predominantly painful area being located in the frontal region. This seemed a good opportunity of testing the above method of locating the action of remedies upon the intracranial structures.

Accordingly I placed the patient upon his back, injected into both nostrils, as high up as possible, several drops of a medicated solution, aggregating morphine $\frac{1}{8}$ grain and atropine $\frac{1}{100}$. Ten minutes later, there being as yet little diminution of the pain, I compressed both jugular veins in the manner previously set forth.

The relief thus afforded excited the wonder of the patient, who declared, after the lapse of five minutes from the time of applying the compression to the jugulars, that he "felt no pain."

Later he informed me that the relief thus obtained was unusually prolonged, there being little or no pain experienced during the entire following week. I shall have something to say regarding the subsequent history of this interesting case, at some future time. My object in citing it on the present occasion is merely to show how promptly a relatively severe frontal headache was relieved by medication by the nose, combined with simultaneous compression of the internal jugulars.

Mrs. E. N. T—— was referred to me by Dr. Charles A. Limeburner for severe, continuous local headache, possibly the result of circumscribed chronic meningitis (?).

Five months ago, while walking in the garden, patient stepped upon the prongs of a rake, which had been allowed to remain in an upright position, so that the handle leant against a wall. The result of this action was to cause the implement to fly forward, inflicting a blow of such severity upon the left side of her head that she fell to the ground in a state of partial or total unconsciousness.

On regaining consciousness, she felt nothing more than the soreness which might naturally have been anticipated from the violence of the contusion. In a few days, however, quite severe pain set in, the painful sensations being deep-seated and corresponding quite accurately with the area of traumatism, *i.e.*, the left parietal region.

As the pain was not relieved by extracranial measures, and as the various coal-tar derivatives did not seem to help her much, or, at all events, but slowly, I decided to endeavor to act more directly upon the intracranial structures by invoking the method of medicinal localization previously described.

Accordingly, while the patient lay on her back, I sprayed into her nostrils morphine, gr. $\frac{1}{8}$; atropine, gr. $\frac{1}{200}$. Ten minutes thereafter, patient experiencing little relief, I applied the pneumatic compressor over the jugular veins, with the result that, within five or six minutes from the moment of its adjustment, there was complete cessation of pain. Here, again, we have conclusive proof of the increased physiological potency of medicinal solutions, when they (the solutions) are made to linger in the tissues of the brain or other portion of the central nervous system by the aid of artificially induced stasis or partial stasis in the

capillaries. Such stasis may be induced in three ways —and I have tried them all—first, by compressing the carotids; secondly, by compressing the jugulars; and lastly, by compressing both the arteries and veins. Compression of the jugulars with the least possible interference with the circulation in the carotids, will alone be discussed on this occasion.

Compression of the jugulars by the aid of the pneumatic compressor, as here described, is not difficult, especially when the patient reclines in a dorsal position, the head being thrown slightly backward so as to place the vessels slightly on the stretch. This procedure may be invoked without hesitation in the treatment of individuals under forty years of age.

In elderly persons, on the contrary, where an atheromatous condition of the cerebral blood-vessels is among the possibilities, it will be well either to abandon this mode of treatment, or to compress both arteries (carotids) and veins (jugulars) at once, thus avoiding an increase in intra-arterial pressure and consequent danger of rupture and hemorrhage.

Mr. V. N——, also kindly referred to me by Dr. Charles A. Limeburner, has suffered for several months from what Dr. Limeburner believes, and rightly, I think, to be neurasthenic headache.

The chief complaint of this gentleman is that he is beset by a sensation of heaviness in the head, more or less continuous, and frequently coupled with dull pain at the vertex and profound depression. In addition to these symptoms, he also evinces dread of responsibility and society, loss of memory, especially for recent events, inability to concentrate his attention for any length of time without discomfort; and, in

short, he affords a typical illustration of the classical form of cerebral neurasthenia.

With a view to at once gain his confidence by relieving his head symptoms—the vertical pain, the heaviness, and the depression—I proceeded to invoke once more the aid of medicinal localization.

Instilling into the nasal cavity a few drops of water containing atropine, $\frac{1}{100}$, and cocaine, gr. $\frac{1}{4}$, I applied the pneumatic compressor, as already so frequently described. After the lapse of five or six minutes there was a decided feeling of relief, and in ten or twelve minutes the disagreeable head symptoms had entirely disappeared. The relief in this case was complete during the following five or six days, when the procedure was again repeated, with the same results. As a matter of course, various measures directed to the removal of the exciting cause were employed in this as in all similar cases, but as they have no bearing on the point at issue, and involve, moreover, matters which are part of the common knowledge of the profession, I have made, and shall in future make, no detailed reference to them. As a matter of theoretic interest, I may observe that, after instillation of the atropine and application of compression to the jugulars, there was marked dilatation of the pupils.

Mr. J. E. K—— has been kindly referred to me by Dr. Fayette Smith, on account of an obstinate form of myalgia. He also suffers from attacks of mental hebetude, depression, and headache. During one of these seizures, which failed to yield to either salol and phenacetine, or antipyrine and ammonia, I instilled into his nostrils morphine, gr. $\frac{1}{8}$, atropine, gr. $\frac{1}{100}$,

and hyoscine hydrobrom., gr. $\frac{1}{300}$, and shortly thereafter applied the pneumatic compressor to the jugulars.

As a result all the disagreeable symptoms disappeared within ten or fifteen minutes, much to the delight and astonishment of the patient, who had hitherto failed to obtain relief from several remedies administered in the conventional manner.

Mr. L. E—— has been referred to me by Dr. David Webster, on account of paralysis of the third nerve, with concomitant headache, both phenomena being doubtless specific in origin. Dr. Webster has already obtained some amelioration by the administration of the iodide of potash combined with inunctions of the oleate of mercury. As, however, there is still considerable diplopia, Dr. Webster feels that local applications of electricity should be tried. Accordingly, I have made such applications (of faradism) as near the vicinity of the affected muscles (left internal and inferior rectus) as possible, employing for the purpose a delicate conical sponge electrode.

The benefit accruing from this phase of treatment has been rapid, the double vision having quite disappeared after the third application. I may add, in this connection, that the eye was thoroughly cocainized before applying the electrode, the lids being held apart by an ordinary eye-speculum.

And this brings us to the point of special interest in connection with the present argument. As has already been said, this patient was a sufferer from headache of a persistent, dull character, culminating, at times, in exacerbations of considerable severity.

At my request he called at the office during one of these attacks, and I proceeded at once to attempt to

abolish the painful symptoms. Spraying the nasal cavity with an aqueous solution of morphine, gr. $\frac{1}{8}$; cocaine, gr. $\frac{1}{3}$; and hyoscyaminæ sulphas, gr. $\frac{1}{100}$, I had the patient remain in a recumbent position for ten or fifteen minutes. At the end of this time, he stated that he felt "somewhat better;" but, as the relief was not complete, I at once applied the pneumatic compressor to the jugulars, when the patient almost immediately declared that all pain had vanished.

Mrs. C. L. V—— was referred to me by the late Dr. James R. Leaming, on account of persistent insomnia, accompanied by attacks of dull, clawing pain at the vertex. As the patient was much debilitated, and as changes in position—and notably lying down and suddenly sitting up—had a perceptible effect upon the character of the pain, I concluded that circulatory anomalies, probably anæmia, had something to do with its genesis. Accordingly, I applied the compressor to the jugulars, with the result that considerable relief was at once afforded. This improvement was, however, evanescent; for, on removal of the compressor, it shortly returned.

I then proceeded as in the previous case, instilling at first the analgesics and sedatives into the nasal cavity, and then applying the compression to the jugulars. Precisely the same results were obtained as in the previous case—relief from pain, lasting several hours.

This case is interesting, as it affords incontestable proof of the superiority of jugular compression combined with intranasal medication over jugular compression alone.

Mr. G. F—— was referred to me several years ago by the late Dr. Cornelius R. Agnew, on account of spinal neurasthenia, accompanied by impairment of sexual vigor and insomnia. For several years patient had been harassed by imperative craving for alcoholic stimulants, the morbid desire occurring periodically, twice or thrice yearly. The excesses which resulted from these impulses always left the patient tremulous and greatly prostrated, and eventually he became a victim of obstinate and constantly recurring headaches, in addition to the symptoms which had more especially attracted Dr. Agnew's attention. The eye conditions bore no special relation to the case, consisting as they did in a minor degree of hypermetropia and conjunctivitis. Appropriate glasses had corrected the first, and a simple eye-wash the second element, so that when he arrived at my office the nervous phenomena were the predominant, and indeed the only, feature. These I was able to abate by a course of treatment of reasonable length; but I was not able to overcome the patient's imperative impulses to periodic spreeing.

Thus it happened that, for the last few years, this gentleman has been in the habit of seeking me out, after one of these debauches, with a view to having the results—the head pains, the tremor, the depression—eliminated. Recently he called upon me for the usual purpose, suffering, as he declared, more than on former occasions. Especially annoying was the sensation of fulness and pain in the head, which made him feel, as he expressed it, "as though he would like to jump off the dock." This seemed a good opportunity to endeavor to relieve the pain by concentrating

the effect of the remedies employed by the aid of jugular compression.

As the patient was a sufferer from an old catarrhal difficulty, which had evidently deprived the nasal mucous membrane of much of its absorbent power, I decided to administer the remedies by the mouth. I quite realized that in doing this, I was resorting to a method inferior to that previously described, when judged by rigid physiological standards; for these demand the placing of the medicament as near the nervous structure to be affected as possible. However, I could not help feeling that the retardation of the medicated blood in this way would eventuate in some enhancement of physiological effect, and the sequel proved that the inference was a correct one.

As a preliminary precaution, the patient was given forty drops of the aromatic spirits of ammonia, and shortly afterward fifteen grains of antipyrine were administered. Though the ammonia, being quickly absorbed, induced a considerable increase in the frequency and vehemence of the heart's action, there was no abatement in the head symptoms—the pain, hebetude, and depression—even after the lapse of half an hour. And yet there was some diaphoresis, showing that a considerable quantity of the antipyrine had been absorbed.

It was at this juncture that I applied the pneumatic compressor to the jugulars in the usual way.

The phenomena thereby evoked appeared within five minutes and were truly remarkable, if credence is to be given to the patient's own statements. He declared that the heavy feelings in the head had disappeared; that he no longer felt pain; that the de-

pression had entirely relinquished its hold upon him; and that, in a word, he was "cured," as he laconically expressed it.

Obviously, the plan of treatment just described has distinct advantages; for, when the nasal mucous membrane is sufficiently healthy to absorb the medicament, the stomach, if delicate, may be spared the reception of chemical products which might add to the local derangement. Powerful alkaloids are those best adapted to this form of administration, as they may be given in small doses, and are, therefore, readily taken up by the nasal mucous membrane, whose power of absorption is limited. Again, there is little or no danger of setting up a pernicious habit, as is the case in hypodermic exhibition. Then, too, the prompt relief of intractable symptoms in a relatively short time, and without inordinate drugging, is a notable advantage. Finally, I would add that where the nasal mucous membrane is not sufficiently healthy to absorb the medicated fluid in sufficient quantity it may be injected into or beneath the intranasal mucous membrane by the aid of a long hypodermic needle attached to the syringe conventionally employed. This I have done on one occasion, only.

APPENDIX.

EYE STRAIN

AS A

CAUSE OF HEADACHE

BY

DAVID WEBSTER, M.D.,

Professor of Ophthalmology in the New York Polyclinic; Surgeon to the Manhattan Eye and Ear Hospital; Consulting Eye Surgeon to the Skin and Cancer Hospital; to the Hospital for the Ruptured and Crippled, to the Hackensack Hospital, to the House of Mercy, New York, etc., etc.

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INTRODUCTORY.

THAT headaches are frequently caused by eye-strain resulting from various abnormal conditions of the visual organs has long been well known to the ophthalmologist, and is beginning to be recognized as a fact by the medical profession generally, as well as by the laity. A considerable proportion of the practice of every ophthalmologist is made up of patients referred to him by their family physician, or coming to him of their own accord, who are conscious that their headaches are directly traceable to the use of their eyes, and who hope to get relief by wearing properly selected glasses, or by such other means as the skilled ophthalmologist may suggest.

Headaches dependent upon inflammatory conditions of the eyes, or of their appendages, do not come within the scope of this paper. We shall confine our remarks to those headaches which are dependent upon

1. Errors of refraction,
2. Impaired accommodation, and
3. Insufficiency of the extrinsic ocular muscles.

CHAPTER I.

HEADACHES DEPENDENT UPON ERRORS OF REFRACTION.

It must not be supposed that all persons who have errors of refraction are subject to headaches, or other reflex troubles, caused by the same. On the contrary, this is true of a very small proportion of such persons. The fact is that very few persons are free from refractive errors. Probably there are not more than half a dozen emmetropic eyes out of every hundred. But the great majority of ametropes suffer no especial inconvenience from their refractive errors. The fact remains, however, that a certain proportion of such cases are the victims of headaches, and that nothing but the wearing of glasses correcting their ametropia will afford them relief. Therefore, in all cases where the patient refers his headache to the use of his eyes, either for near or for distant vision, he should be carefully examined by a competent ophthalmologist, and if ametropia be found it should be duly corrected. Indeed, in every case of headache, where all other causes have been excluded, it is well to have the condition of the eyes investigated. For it is not uncommon to find a considerable degree of refractive error, entailing a large amount of ciliary strain, where the patient does not refer any of his symptoms to his eyes, but is inclined to boast of the perfection of those organs. The strain is there, nevertheless, but it makes itself felt elsewhere.

The following case illustrates the relief of headache by the constant use of glasses correcting a moderate

amount of hypermetropia, or oversightedness, in a young person.

Case I.—Feb. 9, 1887.—John E., æt. 20, student, complains of pain in the eyes after reading, and on exposure to bright light. The reflection from snow is especially trying. He has, for the last three or four weeks suffered from *headaches* after even moderate use of his eyes.

Vision=$\frac{20}{20}$; Hm $\frac{1}{60}$, both eyes.

Orthophoria (physiological equilibrium of ocular muscles).

Abduction 4°; adduction 10°.

Ophthalmoscopic examination shows that the media and fundus are normal.

Feb. 17.—Under atropia, V = $\frac{20}{20}$ with + $\frac{1}{24}$, both eyes. Abduction 5°; adduction 13°.

Feb. 26.—Ordered spectacles + $\frac{1}{36}$ for constant use.

Jan. 26, 1889.—Mr. E. returns, saying that he wore the glasses only about three months, when finding on trial that the pain in his eyes and head did not return on leaving them off, he discarded them entirely. He is now married, and is devoting himself to the study of paleontology, involving a great deal of close use of the eyes. About a month ago the headaches returned. The pain is confined mostly to the frontal region, and the attacks occur about twice a week. Each attack lasts five or six hours. When the attack comes on he goes to bed as soon as possible, and after five or six hours' suffering he goes to sleep and "sleeps it off," awaking, after some hours of sleep, free from headache. These attacks are sometimes accompanied with nausea, never with vomiting. The severer attacks come on after prolonged use of his eyes. The print often appears blurred after he has read for a short time.

V = $\frac{20}{15}$; Hm 0.5 D., both eyes.

Hyperphoria 0° ; esophoria 2° ; in accommodation, none. Abduction 6° ; adduction 14°; sursumduction, R. 1° ; L. 1°.

No lesion of media or fundus.

Ordered glasses + 0.75 D. for all the time.

April 16.—Mr. E. says he has been wearing the glasses constantly as ordered, and that he has not had more than three attacks of headache in the last three months. Two of these attacks were, he feels sure, not due to eye-strain, but occurred after imprudence in diet. The other attack was one of the old headaches, and he had to go to bed and "sleep it off" as he used to do.

The eyes are so constituted, and are in such relation to the nervous centres, that they *will see as clearly as possible*, independently of any conscious volition on the part of the individual. It is necessary to distinct vision that the rays of light proceeding from the object seen should be brought to a focus upon the retina. In ordinary distant vision, the emmetropic, or normally shaped eye accomplishes this *without any effort*, because its antero-posterior diameter bears such a relation to its refractive media that parallel rays are brought to a focus upon its retina without any effort of adjustment, that is, with its ciliary muscle in a state of relaxation. But in the hypermetropic eye, which is shorter in its antero-posterior diameter than the emmetropic, when the ciliary muscle is at rest the focus for parallel rays is *behind* the retina. If it were possible for a hypermetrope to go about without keeping up a constant accommodative effort he would see all objects under circles of dispersion, and his distant vision would be as indistinct as that of a myope, or near-sighted person. This state of things actually exists in all cases where the power of accommodation has been lost in

hypermetropic eyes, either from old age, or from disease, or from the use of mydriatics; and indeed it is always present in very high degrees of hypermetropia, the hypermetropia being so great that the individual cannot overcome it by any effort of accommodation. The ciliary muscle, failing to increase the focalizing power of the crystalline lens sufficiently to secure even moderately clear vision, gives it up, so to speak, and the eye contents itself with such poor vision as it can secure without any effort. It is hardly necessary to say that in these cases of hypermetropia, where the ciliary muscle remains relaxed, and the alternative of blurred vision is accepted, there is no headache, so far as the factor that we are now speaking of is concerned. But in all moderate, and even considerable, degrees of hypermetropia, in young persons, clear vision is constantly kept up by *constantly contracting* the ciliary muscle. In *near* work, such as reading, writing, drawing, sewing and painting, the ciliary muscle of the hypermetrope has to do exactly as much work as that of the emmetrope, *in addition* to the work that it has to perform constantly when gazing upon distant objects. In short, the ciliary muscle of the emmetrope is at rest except when he is engaged in *near* work, while that of the hypermetrope is at work always, except when his eyes are closed, and does additional work while looking at near objects. In consequence of this constant and unremitting use the ciliary muscles of the hypermetrope become increased in size and in strength, and thus, in the great majority of cases are enabled to bear the additional strain. But if the general muscular system chances to be weakened by an attack of illness, or if the already overworked ciliary muscle is given additional labor, as in the case of a college student preparing for examination, or in the

case of a person studying any science enthusiastically day and night, the result is likely to be *headache*, which can be relieved only by resting the ciliary muscles.

Thus in the case of the hypermetrope reported above, his first breakdown was caused by over-use of his eyes at college. He needed the relaxation afforded by glasses only to bridge him over that period. As soon as he was in circumstances to give his ciliary muscles a partial rest the glasses were laid aside with impunity. When he plunged into work again, involving extra use of his eyes, the headaches returned in a worse form than before, and he was compelled to resume the use of spectacles.

Case II.—July 1, 1886.—Mrs. Dr. J. J. R., æt. 33, has all her life been subject to attacks of migraine, but the attacks have been more frequent and more severe for the last eight or nine years. Although she does not complain of her eyes her husband brings her for examination in the hope that the headache may be found to be due to eye-strain, and that she may get that relief, through treatment of her eyes, or through spectacles, which all other means have failed to afford.

R. V = $\frac{20}{50}$; $\frac{20}{20}$ + with + $\frac{1}{48}$ cylindric, axis 90°.
L. V = $\frac{20}{30}$; $\frac{20}{20}$ − with + $\frac{1}{60}$ cylindric, axis 90°.
Orthophoria ; exophoria in accommodation 4°.
Abduction 4°; adduction 14°.
Ophthalmoscope ; no lesion.
July 2.—Both eyes under atropia:
R. V = $\frac{20}{50}$ + with + $\frac{1}{48}$ s, ⌒ + $\frac{1}{48}$ c., ax. 90°.
L. V = $\frac{20}{20}$ + with + $\frac{1}{42}$ s, ⌒ + $\frac{1}{60}$ c., ax. 90°.

July 12.—The patient accepts only the cylindrics, the glasses which improved her vision before atropia was dropped into her eyes.

Glasses, + $\frac{1}{48}$ c., ax. 90°, for right eye, and + $\frac{1}{60}$ c., ax. 90°, for left eye, were prescribed for constant use.

January 3, 1887.—Dr. R. says the patient has been very much better, but not entirely free from her attacks of headache.

April 26.—The patient states that her attacks of headache are reduced at least seventy-five *per cent.*, but that for the last two months they have been coming on more frequently again. The glasses which were found to correct the total error of refraction were now accepted by the patient, and she was advised to wear them instead of the partial correction which she had been using. I received a letter from her husband, dated Feb. 1, 1889, nearly two years after the last glasses were prescribed, in which he stated that she had experienced great relief, but that she had recently had a partial relapse. I referred him to another ophthalmologist in a distant city to which he had removed, and have not since heard from the patient.

The eye-strain which caused the headache in this case was due to compound hypermetropic astigmatism. The unequal contraction of the ciliary muscle which is necessary to produce a compensatory assymmetry of the crystalline lens, and thus to neutralize the astigmatism of the cornea and procure as clear vision as possible, is, I believe, a prolific source of headache. As in the case just related, correction of the astigmatism alone is often sufficient to afford temporary relief. It generally becomes necessary later to correct the hypermetropia also.

Case III.—January 28, 1889.—Sidney G., æt. 33, bachelor, no occupation, was referred to me by Dr. J. Leonard Corning with a letter, saying: "Mr. G. is a sufferer from general anæmia coupled with various nervous symptoms, notably exhaustion, vertigo and painful sensations in the head. These phenomena are particularly pronounced in the morning. The head symptoms are often evoked by reading."

Mr. G. had been under severe emotional strain for several years on account of the incurable illness of his mother, had kept late hours and had studied hard. His attack of nervousness and headache had lasted for over six weeks.

R. V = $\frac{20}{15}$; Hm 0.50 D.

L. V = $\frac{20}{20}$; $\frac{20}{15}$ with + 0.50 D. cyl., ax. 90°.

Orthophoria ; exophoria in accommodation, 1°.

Abduction 6°; adduction 29°; sursumduction R. 1°, L. 1°.

January 30.—Under homatropine:

R. V = $\frac{20}{30}$ −; $\frac{20}{15}$ with + 0.50 D. cyl., axis 70°.

L. V = $\frac{20}{30}$ −; $\frac{20}{15}$ with + 0.75 D. cyl., axis 110°.

Ophthalmoscopic appearances normal.

February 1.—The above cylindrical glasses, which gave him the best vision while his accommodation was suspended by homatropine, being now placed before the patient's eyes, in trial frames, were found to be comfortable while they sharpened his vision a little. They were, therefore, prescribed for constant use.

February 16.—Mr. G. has been wearing the glasses constantly since ordered, and expresses himself as much relieved by them. Dr. Corning, who kept the patient under treatment for some time, assures me that the glasses aided him greatly in the restoration of Mr. G.'s health, and in the permanent relief of his headache.

Thus we find that the correction of ocular errors, while not of itself always sufficient to relieve head symptoms, is often an invaluable adjunct to medical treatment.

Case IV.—Nov. 15, 1887.—G. E. K., æt. 33, banker, was referred to me by Dr. E. C. Seguin, who wrote: "He presents the occipito-cervical symptoms characteristic of eye-strain."

I found that Mr. K. had been fitted with cylindrical glasses by a distinguished ophthalmologist some years previously, but that they failed to relieve his eye-strain and headache. The glasses were + 1.25 D. c., axis 90°, both eyes.

R. V = $\frac{20}{20}$ + ; $\frac{20}{15}$ with + 0.50 D. c., axis 90°.

L. V = $\frac{20}{30}$ + ; $\frac{20}{15}$ with + 0.50 D. c., axis 90°.

He could still see $\frac{20}{15}$ with both eyes at once if + 0.50 s. were added to the above glasses.

Although there was insufficiency of the externi of 1° to 2°, and his power of abduction was only 4°, about half what it ought to be, he rejected prisms as making him very uncomfortable. After much patient testing I found + 0.75 D. c., ax. 90° both, to be the glasses which afforded him the most relief. I therefore ordered them for constant use.

April 19, 1889.—Mr. K. says he has worn the glasses constantly since they were ordered, except when exercising in the open air, and that since he has been wearing them he has experienced entire relief of his occipito-cervical pain, except when he indulges in over-work, which easily brings it on. Recently he has felt a "sort of nervousness" in and about his eyes.

Upon testing his eyes again, it was found that they now accepted + 1 D. c., ax. 90°, both. He was therefore directed to have his glasses changed accordingly.

The glasses which this patient had been trying to do his near work with before I saw him gave him very little relief, because they over-corrected his hypermetropic astigmatism. I corrected his manifest astigmatism and the glasses were worn with relief from the first. It was necessary to change them for stronger ones because some of the hitherto latent hypermetropic astigmatism had been made manifest by the spontaneous relaxation of the ciliary muscles.

CHAPTER II.

HEADACHES DEPENDENT UPON IMPAIRED ACCOMMODATION.

The most common form of impaired accommodation is that due to presbyopia, or old sight. The crystalline lens, like all the other tissues of the body, becomes harder as we grow older, and therefore less easily changed in shape by the action of the ciliary muscle. So that the presbyope is compelled to put forth additional effort in order to focalize upon the retina rays of light coming from near objects. The ciliary strain thus induced often causes headache, among other symptoms of asthenopia. The most familiar indication of presbyopia is a tendency to hold the book farther away from the eyes, and a blurring of fine print at any distance. When this occurs the cause is generally understood, and the patient cures himself by selecting glasses at an optician's. But when pain in the eyes and head, or slight blepharitis or conjunctivitis with sensitiveness to light, itching of the eye, etc., are the first symptoms that show themselves, the patient is apt to apply for relief to the neurologist or ophthalmologist; or, perhaps, first to his family physician, who refers him to the latter. We should not omit, then, to prescribe glasses for such patients, even although the power of accommodation still appears to be ample. Weak convex glasses usually give the required relief, provided the patient can be persuaded to wear them notwithstanding his ability

to read without them. Weak accommodation occasioned by paresis of the ciliary muscle should be supplemented by well-selected spectacles. Some have reported good results from the local use of a weak solution of eserine or pilocarpine in cases of weakness of the ciliary muscle.

CHAPTER III.

HEADACHES DEPENDENT UPON INSUFFICIENCY OF THE EXTRINSIC OCULAR MUSCLES.

A FRUITFUL source of headache is the want of proper balance, or of physiological equilibrium, of the muscles that move the eyes. Binocular single vision for distant objects should be maintained without effort. When one set of ocular muscles is relatively stronger than the opposing set an extra out-put of nervous energy is required to keep both eyes fixed upon the same object. There is a tendency of one eye to turn away from the object in the direction of the stronger muscle. An extra innervation has to be communicated to the weaker, opposing muscle. The eye-strain thus produced, with the multitude of consequent asthenopic and nervous symptoms, can only be relieved by restoring the ocular balance, and this is generally only to be accomplished by the use of prismatic spectacles, or by graduated tenotomy of the too-strong muscle.

CASE V.—Oct. 19, 1888.—Mrs. Dr. C. E. F., æt. 28, has suffered, for many years, with severe pain in the back of the head and neck, tenderness over the mastoids, and aching of the eyes. These pains have been aggravated by use of the eyes for reading and other near work, but she has suffered more or less from them most of the time. She has made it a rule never to give up as long as she could possibly help it, but sometimes she has had to go to bed. She was kept under morphine for two or three days at one time, but as

soon as the effects of the drug passed off the pains returned as bad as before. Mrs. F. has been wearing spectacles $-\frac{1}{14}$ s., which have improved her distant vision without relieving her headache.

V = $\frac{10}{200}$; $\frac{20}{15}-$ with $-$ 3.50 D., each eye.

Hyperphoria 0°; esophoria 2° to 3°, the same in accommodation. Abduction 5°; adduction 28°, sursumduction R. 1°, L. 1°.

Ophthalmoscopic examination shows slight "erosion" at temporal edges of disks.

Ordered—3.D. ⌒ prism 1½°, base out, each eye, for all the time.

April 17, 1889.—Mrs. F. says that since she has been wearing the glasses ordered last October she has had very little headache. After the first month's use of the glasses she has had scarcely any.

In this case it was not sufficient to correct the error of refraction. It was also necessary to take the strain off her too weak externi, and this was done by combining prisms with her concave glasses.

Case VI.—Jan. 21, 1887.—Miss Ada P., æt. 36, has all her life been subject to neuralgic headaches. They always occurred when she got tired, or when anything caused the blood to rush to her head. In 1876, while attending the Centennial Exhibition at Philadelphia. she noticed that after using her eyes continuously for two or three hours she was sure to have pain in the back of her head. Last winter a New York optician fitted her with glasses for distant vision which she wore with benefit. Last Christmas she sewed most of the day and in the evening read, and was attacked with a feeling of involuntary contraction in the eyes. Then pain came on and extended from her eyes to the root of her tongue, to her left ear, and to the back of her head and down her shoulders and back. She has been

unable to use her eyes since without producing similar sensations.

R. V = $\frac{20}{20}$ − ; emmetropic.

L. V = $\frac{20}{30}$ − ; $\frac{20}{20}$ with − $\frac{1}{60}$ cyl., axis 180°.

She is wearing, Rt.− $\frac{1}{48}$ c., ax. 180°.

Lft.− $\frac{1}{36}$ c., ax. 180°.

No insufficiency for the distance.

Esophoria in accommodation 13°.

Abduction 6°; adduction 10°.

January 22.—

R. V = $\frac{20}{15}$ with − $\frac{1}{144}$ c., ax. 180°.

L. V = $\frac{20}{15}$ with − $\frac{1}{72}$ c., ax. 180°.

The above glasses were ordered for the distance.

January 24.—Ordered for reading:

Rt. + $\frac{1}{144}$ c., ax. 90°.

Lft. + $\frac{1}{48}$ c., ax. 90°, ⌒ prism 4°, base to nose.

With these glasses the patient was directed to read twice daily, beginning with five minutes and increasing the task two minutes daily.

February 7.—Miss P. is reading half an hour morning and afternoon without disagreeable sensations.

February 25.—Her tasks have reached an hour twice a day. As she had experienced no further trouble she was advised to stop her regular tasks and use her eyes as occasion might demand.

I met her some time afterward, at the Manhattan Eye and Ear Hospital, where she brought a poor patient to see me, and she said that her glasses seemed to have banished the headaches permanently.

Case VII.—February 23, 1886.—Lizzie V. S., æt. 19, complains of pain in her eyeballs and of "heavy headaches." She has been out of work for three months on account of ill-health caused, as she thinks, by straining her eyes.

V = $\frac{20}{200}$; $\frac{20}{20}$ with − $\frac{1}{14}$, each eye.

Orthophoria; exophoria in accommodation, 14°.

Ophthalmoscopic examination shows commencing staphyloma posticum in both eyes.

Under atropia, R. V = $\frac{20}{20}$ with $-\frac{1}{13}$; L. V = $\frac{20}{20}$ with $-\frac{1}{14}$. Exophoria 4°. The right eye appears to turn out at times.

Ordered $-\frac{1}{14}$ s., ⌒ prism 2°, base in, both eyes.

May 28.—The patient states that she has worn the glasses constantly, for near and for far. She has had no headaches since wearing the glasses. She has had only one attack of pain in her eyeballs and that was not severe and lasted only a short time.

I might multiply cases in which headaches had been totally, partially, or temporarily relieved by the use of prisms alone, or combined with spherical or cylindrical glasses. But that is unnecessary. I have cited a sufficient number to show that in all cases of headache not relieved by other means prisms should be *tried*. Unfortunately the vast majority of patients who theoretically need prismatic spectacles and should be relieved by them are unable to wear them. The effects produced upon vision and upon the nervous system by them are so unpleasant that the glasses are quickly rejected. They change the shape of objects; they make the floor or side-walk appear to approach the eyes or to recede from them, thus giving the wearer the sensation of walking up or down an inclined plane, while really walking on level ground; they make one end of the page that is being read narrower than the other end, or give it a slanting or oblique direction when it is being held squarely before the eyes; or they produce faintness, dizziness or nausea. In such cases I have generally found it utterly useless to persuade the patient to continue to wear them. He is rarely able to overcome these disagreeable sensations by any

effort of the will. He rarely can compel himself to ignore them. When the ophthalmic surgeon insists upon his continued attempts to do so he quietly solves the problem for himself by laying aside the glasses and doing the best he can without them, or by consulting another eye surgeon, who prescribes glasses without prisms. Not infrequently the patient accepts the prismatic glasses when placed before his eyes in trial-frames, but rejects them after they have been made for him.

CHAPTER IV.

GRADUATED TENOTOMY OF THE OCULAR MUSCLES.

WHERE there is good reason to believe that the headache is due to insufficiency of the ocular muscles (heterophoria), and prismatic spectacles are rejected, there only remains the resort to graduated tenotomy of the stronger, opposing muscle, so as to restore, as perfectly as possible, the condition of physiological equilibrium (orthophoria). I propose to close this chapter by relating a few cases treated after this method.

CASE VIII.—Miss Alice A., age 27, consulted me on June 13, 1887. After using her eyes she has headache. She cannot look steadily at anything. Her father died insane. His mother, sister and cousin also were insane. She has a cousin in an insane asylum. She broke down after a hard winter's work, and has since had headache almost without intermission. She has a feeling in the back of the head and neck as if her head were being drawn back. She also has a "jumping headache" all over the top of her head. The jar of walking hurts her. Sometimes she feels "sort of lost," as if she did not know anything. For many years she has observed that her left pupil is a little smaller than the right. R. V = $\frac{20}{20}$ − ; Hm $\frac{1}{48}$; L. V = $\frac{20}{20}$ − ; Hm $\frac{1}{48}$. Spectacles + $\frac{1}{40}$ were prescribed, and she was put upon increasing reading tasks.

August 20.—She now reads four hours a day with her glasses. Exophoria 12°; abduction 15° She has

single binocular vision in reading. *Tenotomy of left externus*, leaving orthophoria. June 21.—The headache she had yesterday before the operation was forgotten after it, and has not come on since.

August 27.—She has done her usual work as governess since last here. She has experienced none of the "drawing feeling" in the back of the head and neck, but she has a tired feeling. Orthophoria; abduction 10°; adduction 12°.

Case IX.—Wm. H., age 44, married, merchant, came May 23, 1887. Mr. H. was troubled with headache all his life, and supposed it was due to indigestion until three years ago, when it was suggested that it might be due to eye-strain. He then went to Dr. Stevens, who gave him glasses and exercised his ocular muscles with prisms. The glasses relieved his headaches; but recently he has had a relapse. If he reads at all without his glasses, or even three minutes with them, "his head is wrong," and he becomes intensely sick all over, but does not vomit. His general health is good, his bowels regular; he sleeps well. He never had any disease except malaria. R. V = $\frac{20}{20}$; Hm $\frac{1}{60}$; L. V = $\frac{20}{20}$ − ; $\frac{20}{20}$ + with + $\frac{1}{60}$ c., ax. 90°. Esophoria 3° to 6°; in accommodation 15°; no hyperphoria; abduction 2°; adduction 23°; sursumduction, R. 0°, L. 0°. His glasses are prisms, base out. May 24.—*Tenotomy of left internus*, leaving orthophoria.

September 20.—Mr. M. thinks he was helped very much by the operation, but is not entirely relieved.

September 21.—Esophoria 6°; abduction 2°; adduction 22°; *tenotomy of right internus.*

October 10.—No headaches since the last operation; wears no glasses, and uses his eyes with comfort; orthophoria.

Case X.—Dr. W. S. K., age 32, consulted Dr. C.

R. Agnew on April 25, 1877. He stated that he had no trouble with his eyes until September, 1876, when neuralgic pains about the root of his nose set in while reading. There was a feeling of severe tension over his brow while reading. He used belladonna ointment over his brows until his accommodation grew weak, and he had to give up reading altogether. He then became excessively nervous all over. He consulted Soelberg Wells, who dilated his pupils and found his fundus normal, but that he had Ht $\frac{1}{30}$ each eye. He has worn + $\frac{1}{30}$ constantly since.

Dr. K. says his eyes first "broke down" while working all day with the ophthalmoscope and microscope, and then reading late at night. At Christmas he observed that he would become worse when the gas was lighted. He went to church on one occasion, and the bright light caused great infra-orbital neuralgia and neuralgia of the third division of the fifth nerve. This has been confirmed a dozen times. Reading or walking in bright sunlight invariably brings on pain in the inferior maxillary region, the pain being more especially referred to the front teeth below. His teeth were never tender in mastication, and he has only one carious tooth, the first molar on the right side, and that is well filled. He is troubled with spasms about his internal canthi when he lies down. His digestion seems to be good. Never venereal disease. His father was rheumatic and perhaps gouty. He says he is as nervous as a hysterical woman. He jerks and starts when he goes off to sleep. He suffers from sciatica of the left hip, but he attributes that to a fall from a horse when a boy.

V = $\frac{20}{20}$ each with + $\frac{1}{24}$. No insufficiency. Ophthalmoscopic examination gives him excruciating pain, lasting twenty-four hours or less.

The patient was referred to Dr. E. C. Seguin for an opinion. Dr. Seguin wrote :

"April 25, 1877, Dr. K.'s case has seemed very interesting to me. I am disposed to look upon his hyperæsthesia (face and limbs) as due primarily to insufficient nutrition. He has worked hard and used a diet, which I look upon as perfectly fitted to develop anæmia and neuralgia. I would suggest beefsteak and roast meats twice a day, ale or claret for dinner, and not much starchy food. Thompson's solution of phosphorus may also do good, and relief may be had by the positive pole of the galvanic battery. I don't find the usual symptoms of asthenopia."

April 26.—Hm $\frac{1}{24}$ each. Cooper, and Wells, and Purvis, of London, all examined his eyes under atropine and found that his Ht was $+\frac{1}{24}$. April 19, 1887. —The patient returns to me with a letter from Dr. A. W. Calhoun, of Atlanta. He stated that he got no relief from his glasses, and finally discarded them altogether. Since ten years ago he has suffered agony every hour that he has been awake, and he has been kept awake many nights with pain through the temples, through the roots of the nose, and through the teeth and malar bones. The main pain is through the malar bones and nose. No pain in top of head or in occipital region. R. V $= \frac{20}{20} -$; $\frac{20}{20}$ with $+\frac{1}{40}$; L. V $= \frac{20}{20} -$; $\frac{20}{20}$ with $+\frac{1}{48}$. No hyperphoria ; esophoria 2°; abduction 2°; adduction 12°. May 7.—Esophoria 4°; in accommodation 0°; hyperphoria, R. 1°; abduction 4°; adduction 13°; sursumduction, R. 0°, L. 0°. The patient was now referred to a physician skilled in diseases of the nose, who found that he had a deviated septum and operated upon it. He also operated upon his hypertrophied turbinated bone, but without much apparent benefit. May 12.—*Tenotomy of right inter-*

nus, leaving orthophoria, with abduction 8°; as found on testing half an hour after the operation. May 13.—Went to bed last night with a freedom from pain which he has not experienced for years. Esophoria 4°; abduction 8°. May 21.—Orthophoria; abduction 7°; adduction 19°; much improved. April 2, 1888.—The patient writes, "I have done a hard winter's work in the college and with my practice, and my eyes have held up very well."

Case XI.—Nellie C., age 20, came to me at the Manhattan Eye and Ear Hospital on February 17, 1888. For several years she has suffered from severe headaches, which occurred almost every other day. The pain was principally across the forehead, and very seldom extended to the back of her head. The headaches last two or three hours, and are usually brought on by reading, but sometimes occur without any exciting cause. She has a great deal of facial neuralgia also. Within the past seven months she becomes sleepy after using her eyes in reading or sewing any length of time. She is very often taken with fainting spells, fainting away and becoming quite unconscious. Eight days ago she had two or three such fainting spells. The first fainting spell was about four years ago, when she was attacked with it while grinding coffee. She has usually had these spells not more than once or twice a month. She was ill during the whole of last summer. She was cashier in a store at the time and got very weak.

R. V = $\frac{20}{30}$; $\frac{20}{20}$ w. + $\frac{1}{12}$. L. V = $\frac{20}{30}$; Em. Hyperphoria, R. 3°; esophoria 2°; abduction 3°; adduction 16°; sursumduction, R. 4°, L. 5°. February 25.—Divided the right superior rectus, leaving the hyperphoria exactly corrected. The patient fainted twice during the operation. February 26.—She had some

headache after reading this morning. February 27.—Orthophoria; abduction 6°; adduction 16°; sursumduction, R. 3°, L. 3°. March 2.—Orthophoria. September 14, 1888.—The patient states that she has had no headaches or fainting spells since the operation, a period of nearly a year.

R. V = $\frac{20}{30}$ − ; $\frac{20}{20}$ with + $\frac{1}{60}$ c., ax. 90°. L. V = $\frac{20}{20}$; Hm $\frac{1}{60}$. Orthophoria; abduction 5°; adduction 16°; sursumduction, R. 3°, L. 3°.

May 11, 1889.—I saw this patient at the Manhattan Eye and Ear Hospital about a week ago. She came to report that she had had no headaches or fainting spells since I last saw her, and that she considered herself permanently cured.

Case XII.—Rev. F. D. G., age 30, missionary to China, was referred to me by Dr. E. C. Seguin, with the following letter, dated December 27, 1887: "Rev. Mr. G. has congestive symptoms about the head and a degree of nervous prostration—now relieved. Since eight years he has noticed occipital pain and distress on the prolonged use of his eyes, symptoms suggestive to me of muscular insufficiency in accommodation. He has good vision, and to me, his eyes are about emmetropic."

Upon testing Mr. G., I found: R. V = $\frac{20}{15}$; E. L. V = $\frac{20}{15}$; Hm 0.25 D.; hyperphoria, L. 1°; esophoria 1°; exophoria in accommodation 4°; abduction 4°; adduction 14°; sursumduction, R. 3°; L. 2°. December 28.—Under homatropine: R. V = $\frac{20}{15}$ with + 0.50 D.; L. V = $\frac{20}{15}$ with + 1 D.; hyperphoria, L. $\frac{3}{4}$; abduction 7°.

Ophthalmoscopic examination shows physiological excavation of both discs and pulsation of the retinal veins in both eyes. There was no lesion of either eye except a small white spot just above the right macula.

December 30.—Hyperphoria, Left 1°; tenotomy of the *left superior rectus*, slightly over-correcting the hyperphoria. January 3, 1888.—Abduction 7°. January 6.—Esophoria 2°; hyperphoria, L. ½; abduction 5°; adduction 18°; sursumduction, R. 4°; L. 3°. He was instructed to exercise his interni daily with prisms. January 9.—Abduction 1°; adduction 50°; esophoria 6°; in accommodation 6°. January 13.—Abduction 5°; esophoria 2° to 5°. January 20.—Abduction 7°; hyperphoria, L. 1°; ordered glasses Rt. + 0.25 D., Lft. + 0.25 D. ⌒ 1°, base down, to wear all the time. January 27.—Abduction 6°; hyperphoria, L. 1°. He said he had experienced relief from the use of the glasses, although reading with them for three hours brought on occipital headache, and after continuing the use of them four hours longer the headache was as bad as ever.

Tenotomy of Right Inferior Rectus, leaving a slight over-correction. February 10, 1888.—He reported that his headache had been better and that he read six or seven hours the day before without headache. The tests show orthophoria; ordered glasses + 0.25 D., both eyes, without any prism. March 15.—The patient says his head symptoms have almost disappeared. For a month or more the eyes have been "sore to the touch," and more or less red, especially on rising in the morning. The redness disappears after a while He has had these inflammatory symptoms since wearing the glasses. He was now advised to stop wearing the glasses, and the camphor and borax wash was prescribed for him. Examination showed orthophoria. June 15.—I met the patient outside my office and he informed me that he had no special trouble with his head, although he had been hard at work for some months, and that he anticipated a speedy return to his

missionary duties. October 2.—Orthophoria; esophoria in accommodation 6°; abduction 5°; adduction 30°; sursumduction, R. 2°; L. 2°. Mr. G. was unavoidably detained in this country. He considers himself greatly benefited by the tenotomies, and is doing full work with his + 0.25 D.

May 11, 1889.—Mr. G. states that he has not been troubled by any head symptoms since I saw him and works as comfortably as ever. Orthophoria; adduction 7°. He is about to return to his work in China.

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